PEQUONNOCK RIVER BASIN
BRIDGEPORT, CONNECTICUT

FOREST LAKE DAM
CT 00078

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

AUGUST 1978

UNCLASSIFIED

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KEY WORDS (Continue on reverse side if necessary and identify by block number)

MS, INSPECTION, DAM SAFETY,

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rest Lake Dam

ABSTRACT (Continue on reverse side if necessary and identify by block number)

e dam is approx. 1,650 ft. in length. It consists of both natural earth for- tions and an earth embankment with mortar faced rubble core walls. The dam has maximum height of 28 ft. above the original streambed. The top width is 10 ft. th a maximum downstream slope of 2 horizontal to 1 vertical. There exists only o e operable outlet other than the spillway. Single family homes exist at the top the dam, on the downstream side, for approx. 75% of its length. The spillway a broad crested concrete weir, 35.5 ft. long, having masonry rubble training d side walls. The area immediately below the dam and spillway is heavily develope for single family dwellings.

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:

NEDED

Honorable Ella T. Grasso
Governor of the State of Connecticut
State Capitol
Hartford, Connecticut 06115

Dear Governor Grasso:

I am forwarding to you a copy of the Forest Lake Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Protection, the cooperating agency for the State of Connecticut. In addition, a copy of the report has also been furnished the owner, The Lake Forest Association, Inc., 424 Frenchtown Road, Bridgeport, Connecticut 06606, ATTN: Mr. Norman Fuller, President.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Protection for your cooperation in carrying out this program.

Sincerely yours,

JOHN P. CHANDLER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

FOREST LAKE DAM

CT 00078

PEQUONNOCK RIVER BASIN
BRIDGEPORT, CONNECTICUT

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

BRIEF ASSESSMENT

PHASE I INSPECTION REPORT

NATIONAL PROGRAM OF INSPECTION OF DAMS

Name of Dam:	FOREST LAKE
Inventory Number:	CT 00078
State Located:	CONNECTICUT
County Located:	FAIRFIELD
Town Located:	BRIDGEPORT
Stream:	ISLAND BROOK
Date of Inspection:	MAY 23, 1978
Inspection Team:	DEAN THOMASSON
	HECTOR MORENO
	GONZALO CASTRO

The dam is approximately 1,650 feet in length. It consists of both natural earth formations and an earth embankment with mortar faced rubble core walls. The dam has a maximum height of 28 feet above the original streambed. The top width is 10 feet with a maximum downstream slope of 2 horizontal to 1 vertical. There exists only one operable outlet other than the spillway. Single family homes exist at the top of the dam, on the downstream side, for approximately 75% of its length. The spillway is a broad crested concrete weir, 35.5 feet long, having masonry rubble training and side walls. The area immediately below the dam and spillway is heavily developed with single family dwellings.

Based upon the visual inspection at the site and past performance of the dam, the dam is judged to be in good condition. No evidence was observed of structural instability in the embankment and the condition of the earth embankment is generally good. There are some areas which require attention. See Section 7 for further details.

Based upon our hydraulic computations, the spillway capacity is 560 cubic feet per second, which is equivalent to approximately 18 percent of the Test Flood. Based upon the size and hazard classification in accordance with Corps guidelines the test flood will be equal to the Probable Maximum (PMF). Peak inflow to the reservoir is 3,840 cubic feet per second; peak outflow (Test Flood) is 3,150 cubic feet per second with the dam overtopped 0.7 feet. The peak failure outflow from the dam breaching would be 5,900 cubic feet per second.

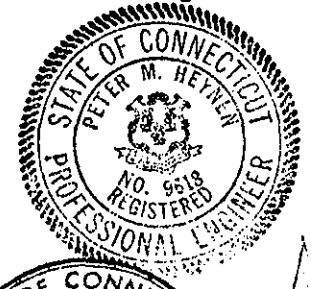
An overtopping of 0.7 feet will flood the houses located immediately adjacent to the toe of the dam. A breach of the dam which would develop a 4 foot wave would create flooding immediately downstream of the dam causing severe damage to life and property.

It is recommended that further studies be undertaken to perform a more refined hydraulic/hydrologic study and determination of the best way to increase the ability of the facility to pass a greater percentage of the test flood. Any increasing of spillway capacity would have to be coordinated with present studies concerning downstream flooding. We recommend increasing spillway capacity because overtopping of the dam has far worse potential for loss of lives than downstream flooding. See Section 7 for further detail.

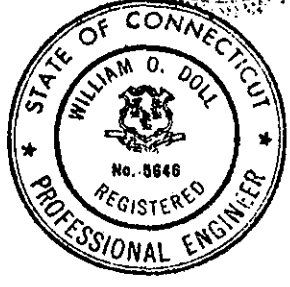
The low level outlet for the dam is not operative. It must be repaired immediately so the dam water level can be lowered for emergencies or maintenance. The high level outlet gate valve is in the downstream face of the dam. It should be replaced by a valve on the upstream side of the high level outlet pipe. Also, the screen chambers for the outlets are not properly covered and are a hazard.

In addition to our investigations, studies by J.W. Cone consisting of an inspection report and recommendations dated June 7, 1966 (Appendix B-19) outline corrective work necessary. Again in February 1969 (Appendix B-50) John J. Mozzochi and Associates in their inspection report outlined similar corrective work. Clarence Blair Associates (in 1971), prepared plans for proposed lengthening of the spillway and channel improvements. This corrective work has not been done to date.

An operation and maintenance plan (see Remedial Measures, Section 7) as well as the recommendations presented above, should be instituted within 6 months of the owner's receipt of this Phase I Inspection Report.



Peter M. Heynen, P.E.
Project Manager
Cahn Engineers, Inc.



William O. Doll, P.E.
Chief Engineer
Cahn Engineers, Inc.

This Phase I Inspection Report on Forest Lake Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Charles G. Tiersch

CHARLES G. TIERSCH, Chairman
Chief, Foundation and Materials Branch
Engineering Division

Fred J. Ravens Jr

FRED J. RAVENS, Jr., Member
Chief, Design Branch
Engineering Division

Saul Cooper

SAUL COOPER, Member
Chief, Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspection. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionarly in nature. It would be incorrect to assume that the present condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions there of. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as neccessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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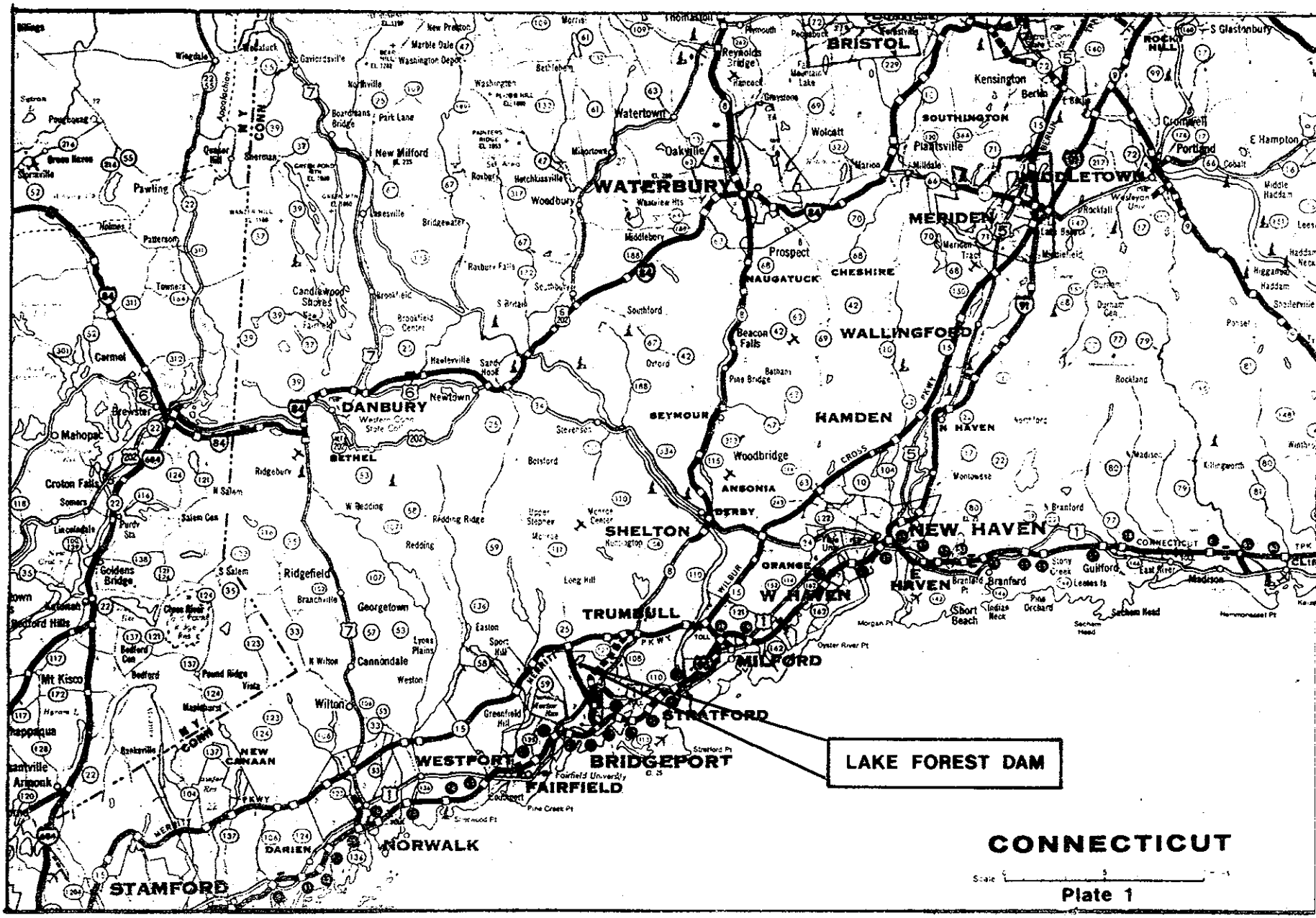
APPENDIX

*See Special Note, Appendix Section B Availability of Data.

OVERVIEW PHOTO

US ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS. CAHN ENGINEERS. INC. WALLINGFORD, CONN. ARCHITECT —— ENGINEER	NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS	FOREST LAKE DAM ISLAND BROOK	BRIDGEPORT CONNECTICUT	DATE 5/23/78 CE # 27 531 GH PAGE 10 x


BRISTOL
WATERBURY
MERIDEN
MIDDLETOWN
SOUTHINGTON
NAUGATUCK
CHESHIRE
WALLINGFORD
DANBURY
SEYMOUR
HAMDEN
NEW HAVEN
ANSONIA
DERBY
SHELTON
ORANGE
TRUMBULL
MILFORD
STRATFORD
WESTPORT
BRIDGEPORT
FAIRFIELD
NORWALK
STAMFORD
NEW CANAAN
DARIEN
WILTON
NORWALK
LAKE FOREST DAM
CONNECTICUT
Plate 1

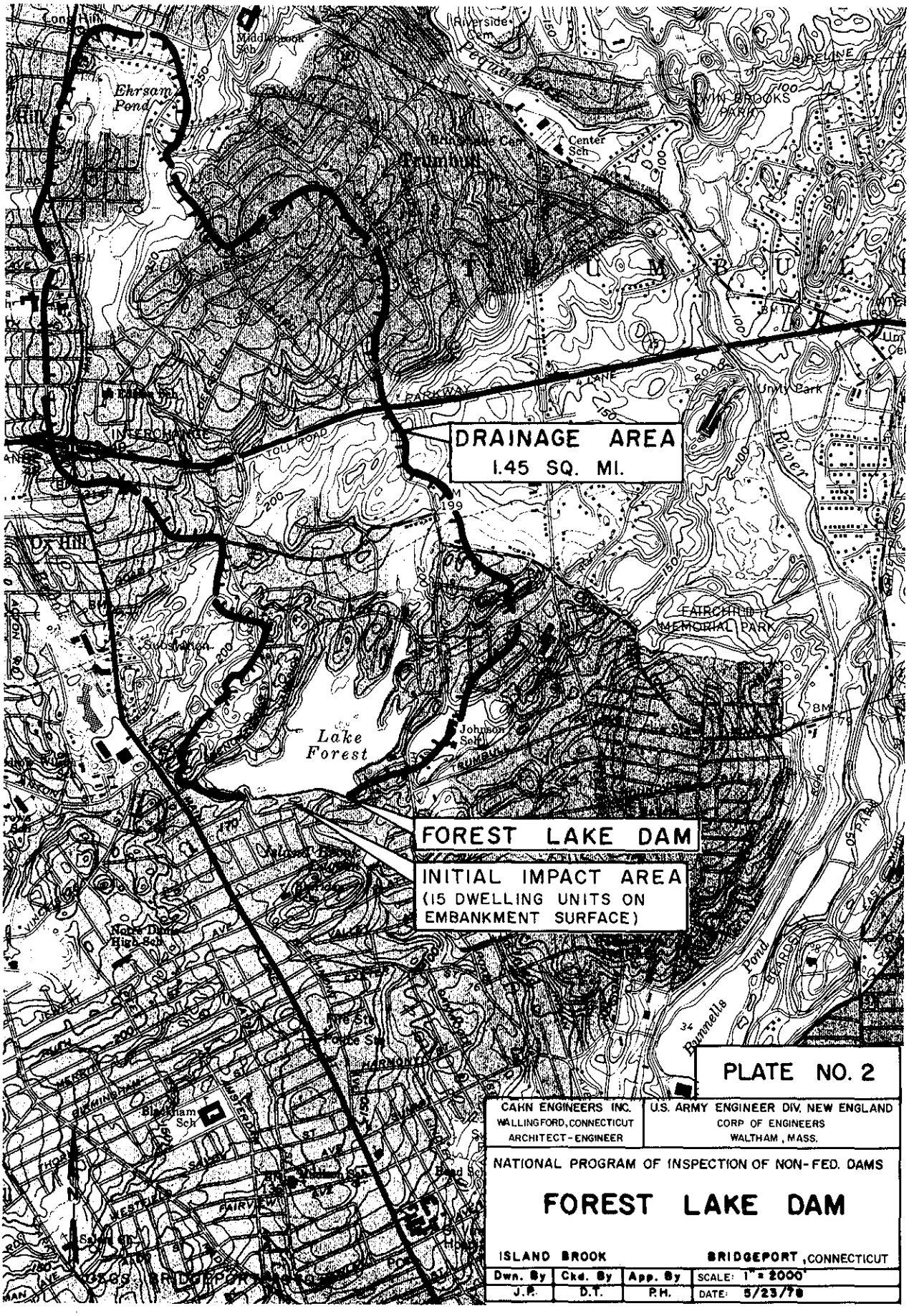


PLATE NO. 2

CAHN ENGINEERS INC. WALLINGFORD, CONNECTICUT ARCHITECT-ENGINEER	U.S. ARMY ENGINEER DIV. NEW ENGLAND CORP OF ENGINEERS WALTHAM, MASS.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

FOREST LAKE DAM

ISLAND BROOK — BRIDGEPORT, CONNECTICUT

Dwn. By	Ckd. By	App. By	SCALE: 1" = 2000'
J.P.	D.T.	P.H.	DATE: 5/23/78

PHASE I INSPECTION REPORT

FOREST LAKE DAM

SECTION I

PROJECT INFORMATION

1.1 General

a. Authority- Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Cahn Engineers, Inc. has been retained by the New England Division to inspect and report on selected dams in the southwestern portion of the State of Connecticut. Authorization and notice to proceed were issued to Cahn Engineers, Inc. under a letter of April 26, 1978 from Ralph T,. Garver, Colonel, Corps of Engineers. Contract No. DACW33-78-C-0310 has been assigned by the Corps of Engineers for this work.

b. Purpose of Inspection Program- The purposes of the program are to:

(1) Perform technical inspection and evaluation of non-federal dams to identify conditions requiring correction in a timely manner by non-federal interests.

(2) Encourage and prepare the States to quickly initiate effective dam inspection programs for non-federal dams.

(3) To update, verify and complete the National Inventory of Dams.

c. Scope of Inspection Program- The scope of this Phase I inspection report includes:

(1) Gathering, reviewing and presenting available data as can be obtained from the owners, previous owners, the state and other associated parties.

(2) A field inspection of the facility detailing the visual condition of the dam, embankments and appurtenant structures.

(3) Computation concerning the hydraulics and hydrology of the facility and its relationship to the calculated flood through the existing spillway.

(4) An assessment of the condition of the facility and corrective measures required.

It should be noted that this report does not pass judgement on the safety or stability of the dam other than on a visual basis. The inspection is to identify these features on the dam which need corrective action and/or further study.

1.2 Description of Project

a. Description of Dam and Appurtenances- At this time the dam consists of both natural earth formations and earth embankments with mortar faced rubble corewalls approximately on center line. The dam is approximately 1,650 feet in length. The top width is 10 feet with a maximum downstream slope of 2 horizontal to 1 vertical. Single family homes exist at the top of the dam, on the downstream side, for approximately 75% of its length. The spillway is a broad crested concrete weir 35.5 feet long, with masonry sidewalls having a steel pedestrian walk located 38 inches above the spillway. There are two valve houses and two gate chambers which outlet through a single 30 inch pipe. The area immediately below the dam and spillway is heavily developed with single family dwellings.

b. Location- The dam is located on Island Brook, in a residential area, in the Town of Bridgeport, County of Fairfield, State of Connecticut. The dam is shown on the Bridgeport U.S.G.S. Quandrangle Map having coordinates of longitude W73 12"32" and latitude N41O 13'9".

c. Size Classification- SMALL (Storage Elevation 178 Top of Dam) (Pool -908 acre ft) (Height Top of Dam to Old Streambed - 28 ft.)

d. Hazard Classification - HIGH (Category I) Single family homes exist at the toe of the dam on the downstream side, for approximately 75% of its length. The area immediately below the dam is heavily developed with single family homes. If the dam were breached, there is a potential that many lives could be lost. Even overtopping of the dam yields a potential for loss of life.

e. Ownership The Lake Forest Association, Inc.
424 Frenchtown Road
Bridgeport, Connecticut 06606
Phone Number (203) 372-9144 Clubhouse
President: Norman Fuller Home# 372-5911
Office# 374-0520
Dam Committee: Bill McCarn 372-0395

f. Purpose of Dam- Recreation

g. Design and Cosntruction History- The following information is believed to be accurate based on the plans and correspondence available and included in the Appendix. Prior to 1899 the dam consisted of earth fill and masonry retaining walls upstream and downstream. The dam incorporates both natural earth formations and man made embankments at low areas. The dam is approximately 50 feet wide at the toe and 25 ft. high. No design or construction history was available. The contractor and engineer are not known.

After 1899 the dam was raised approximately 4 feet by the Bridgeport Hydraulic Company and utilized for water supply. The design engineer was S.G. Stoddard Jr. The contractor is not known. No design or construction history was available for these improvements. The improvements consisted of raising the upstream retaining wall by 6 feet and incorporating this wall as the central corewall by filling and ripraping the upstream face. The high and low level intakes, piping and structures were constructed at this time. A topographic map of the area dated 1908 for the Bridgeport Hydraulic Company shows all construction to be complete. The Bridgeport Hydraulic Company sold the reservoir and dam in 1938 to Island Brook, Inc. The present owner of the dam is the Lake Forest Association, Inc. In the early 1960's under their ownership, the water supply piping to the City was abandoned and outlet pipes constructed from each of the gate chambers, joined and outletted through a single 30 inch pipe approximately 200 ft downstream of the spillway on the left. The engineer and contractor for this work is not known. To the right of the spillway, homes have been constructed in the natural earth formation or by filling on the downstream slope as material was made available. It appears that the spillway may also have been raised approximately 1.4 feet in the early 1960's to its present elevation. The engineer and contractor for the spillway raising is not known.

h. Normal Operational Procedures - The owner stated that from late summer to early winter the lake level is maintained approximately 3 feet below the spillway. The high level intake is used for this purpose. The lake can be lowered at a rate of 1 inch per day depending on precipitation.

1.3 Pertinent Data

a. Drainage Areas - 1.45 square miles (925 acres) in residential area. Mountainous terrain.

b. Discharge at Damsite - Maximum Flood Not Known. Total spillway capacity at elevation 178 (top of dam) 560 cfs.

c. Elevation - (Ft above MSL, USGS Datum)

Top of Dam:	178
Spillway Crest:	174.8
Streambed @ Center Line of Dam:	150
High Level Intake:	167
Low Level Intake:	152
Outlet Pipe:	150

d. Reservoir - Length of Normal Pool: 1500 ft.
Length of Maximum Pool: 1500+ ft.

e. Storage - At Elevation 174.8 852 acre ft.
At Elevation 178 (top of dam) 908 acre ft.

f. Reservoir Surface - At Elevation 174.8 71 acres
At Elevation 178 71+ acres

g. Dam - Type: Earth fill with masonry core approximately on centerline and natural earth formations.

Length: 1,650 feet

Height: 28 ft. above original streambed

Top Width:	10+ feet
Side Slope:	Up stream 1.5H to IV (Max.) Downstream 2H to IV
Impervious Core:	Central masonry core to within 2 ft. of top of dam.
Cutoff:	None Known.

h. Diversion and Regulatory Tunnel - Not Applicable.

i. Spillway

Type:	Broad Crested concrete weir.
Length of Weir:	35.5 feet
Crest Elevation:	174.8
Upstream Channel:	10H to IV
Downstream Channel:	10H to IV, 3 feet high, 20 feet wide, curves right.

j. Regulating Outlets

High Level intake: Size 20" dia., manually operated, located in downstream face at Elevation 167 operational.

Low Level Intake - Size Unknown (estimated 24") manually operated, located in upstream face at elevation 152, inoperative.

Outlet: Combined to 30" dia. pipe

SECTION 2: ENGINEERING DATA

2.1 Design

a. Available Data - The available data consists of drawings, correspondence and calculations by the Bridgeport Hydraulic Company, State of Connecticut, Joseph W. Cone, Lake Forest Association, John J. Mozzochi and Associates, Clarence Blair Associates, City of Bridgeport, Seelye Stevenson Value and Knecht, Inc. and others. Considerable information is available with respect to the hydraulic/hydrologic nature of the facility and its impacts on downstream flooding. The available data is included in the Appendix Section B.

b. Design Features - The available data does not address the design features of the embankment or spillway but does summarize field investigations and assumptions.

c. Design Data - There were no engineering values, assumptions, test results or calculations available for the original construction or later raising. The design data available addresses only the hydraulic/hydrologic characteristics of the facility.

2.2 Construction

a. Available Data - The only available construction drawing appears to be a section titled "Improvements at Island Brook Reservoir" dated May 1899, Appendix B page B-145.

b. Construction Considerations - No data information was available.

2.3 Operation

a. No formal operation records exist. A representative for the Lake Forest Association stated that the low level intake gate valve does not function. Lake level is adjusted through the 20 inch high level outlet.

2.4 Evaluation

a. Availability - Existing data was provided by the State of Connecticut, City of Bridgeport and the owner. The owner made the operations available for visual inspection.

b. Adequacy - Due to the limited amount of detailed engineering data available, the final assessment of this investigation must be based primarily on visual inspection, performance history and hydraulic/hydrologic assumptions.

c. Validity - A comparison of record data and visual observations reveals no observable significant discrepancies in the record data.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General - In general the dam is in need of maintenance.

b. Dam

Upstream Slope - At the time of the visual inspection of the dam, the reservoir level was slightly over the spillway crest, and thus only the upper three feet of the slope could be observed as exposed. The riprap protection inspected generally is in good condition, however, next to the spillway walls there has been some erosion and settling of riprap. Modifications of the upstream slope and crest of the dam have been made by some property owners to facilitate boating or swimming from their properties within an area about 300 to 500 feet to the right of the spillway. These modifications do not appear to have had a detrimental effect on the dam.

Crest - There are bushes and trees growing at several locations along the crest and the upper part of the upstream slope of the dam.

Downstream Slope - A considerable amount of fill has been placed against the downstream slope for home building, as can be seen by comparing the August 1908 topography drawing of Bridgeport Hydraulic Co. with the 1974 topography drawing of the State of Connecticut. The character of the fill placed as compared with the dam materials is not known. It should be pointed out that placement of soil against the downstream slope increases the stability of the dam only if the fill materials are of equal or higher permeability than the embankment. In other words, placement of impervious fill on the downstream face of the dam could adversely affect dam stability.

The downstream filled areas are occupied by homes to the right of the spillway, while to the left of the spillway there is heavy tree and brush cover among piles of fill which were not spread.

No evidence of seepage or wet areas were found on the downstream slope or within an area of about 150 feet downstream of the dam with the exception of a wet area 120 feet downstream of the dam immediately to the left of the spillway channel and near the outlet discharge pipe.

c. Appurtenant Structures

Spillway - The concrete weir shows signs of indentation and deterioration. The training and sidewalls show signs of loose or m missing mortar in between the rubble.

Outlet Works - The high level intake gate house and valve located on the downstream face of the dam, are in good condition and were demonstrated by the owner. The high level intake gate chamber is in good condition. The low level intake gate house located on the upstream face of the dam, is in need of repair. The roof has a large hole in it and the floor is partially collapsed. The valve inside does not function. The valve in the manhole cross over (See Plate No. 3) is in good condition and was demonstrated by the owner. The low level intake chamber is in good condition, however, security devices have been destroyed. The 30 inch pipe which discharges into the spillway channel is partially obstructed with boulders to about its mid-height

d. Reservoir Area - The topography surrounding the reservoir gently slopes to the water. The shore is entirely developed. Sedimentation is not excessive. It is most notable where storm drainage enters the lake.

e. Downstream Channel - The spillway channel has low stone walls within about 50 feet of the spillway. The left wall has partially collapsed while the right wall is in good condition. The channel is strewn with boulders, and there are some tree branches which have fallen into the stream Heavy tree and bush growth next to the channel can, in the future, result in additional branches falling into the channel.

3.2 Evaluation

The condition of the earth embankment is generally good but there are some areas which require attention

a. The trees and bushes growing on the crest, upstream and downstream slopes of the dam present a potential seepage problem. The roots can create seepage paths for the water, particularly after the trees die. Uprooting of trees during windstorms could cause embankment problems

b. The top portion of the upstream slope and the adjacent crest section at the spillway retaining walls have settled or eroded and would cause concentration of water flow if the reservoir level were to approach the crest of the dam. This would increase the possibility of localized erosion and washout at this point

c. The outlet pipe is partially blocked and its flow capacity is thus reduced, decreasing its usefulness in lowering the reservoir in an emergency.

d. The bottom of the spillway channel contains tree branches and other debris which can reduce its flow capacity.

e. The gate structures are in need of maintenance, particularly the low level intake house.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Regulating Procedure

From late summer to early winter the lake level is maintained approximately 3 feet below the spillway crest

4.2 Maintenance of Dam

The owner stated that every two (2) to three (3) years trees and brush are removed from the dam. The spillway area is cleaned as needed.

4.3 Maintenance of Operating Facilities

The maintenance of the facilities is on an as needed basis. The functional gate valves are generally operated at least twice a year.

4.4 Description of Any Warning System in Effect

No formal warning system is in effect. The owner reports emergency situations directly to the Bridgeport Fire Department.

4.5 Evaluation

The operation and maintenance procedures should be improved (see Section 7.2).

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design Data - No computations could be found for the original dam construction. As development downstream has progressed concerns for flooding have increased. The Appendix B contains numerous calculations by consultants retained to study the hydraulic/hydrologic impacts of the facility.

b. Experience Data The worst experience was a situation where 3 boats were adrift blocking the spillway so that water started to cut through the earth on top of the dam. Possible disaster was averted by a member of the Lake Forest Association who happened to notice this at 2:00 a.m., (refer to photographs 1 and 2)

c. Visual Observations - Downstream flooding is a problem and is currently being studied. The spillway is narrow and could be easily blocked.

d. Overtopping Potential - The test flood for this high hazard mall size dam is equal to the Probable Maximum Flood (PMF) of 3150 cfs.

Based upon our hydraulics computations, the spillway capacity is 560 cubic feet per second (Appendix D-10). Based upon "Preliminary Guidance for Estimating Maximum Probable Discharges" dated March 1978, peak inflow to the reservoir is 3,840 cubic feet per second; peak outflow (Test Flood) is 3,150 cubic feet per second with the dam overtopped 0.7 feet (Appendix D-13)

Since the watershed area (1.45 square miles) of Lake Forest is smaller than two square miles, it may be appropriate to consider higher intensity short duration storms. One such calculation is shown in Appendix D-16.

e. Spillway Adequacy - The spillway will pass only 18 percent of the Test Flood at elevation 178 (top of dam elevation).

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations - No evidence was observed of structural instability in the embankment. The appurtenant structures are in need of repair.

b. Design and Construction Data- There is not enough design and construction data to permit a formal evaluation of stability.

c. Operating Records No available recorded information exists that indicates an instability problem.

d. Post Construction Changes - No evidence indicates that construction changes, (i.e.) filling downstream of the dam, has had a detrimental effect on dam stability.

e. Seismic Stability - This dam is in Seismic Zone 1 and hence does not have to be evaluated for seismic stability, according to the U.S. Army Corps of Engineers Recommended Guidelines. In any case, there is not sufficient information available about the materials in the dam and its foundation to make such an evaluation.

SECTION 7: ASSESSMENT, RECOMMENDATION

7.1 Dam Assessment

a. Condition - Based upon the v site and past performance, the dam i condition. No evidence was ob instability in the embankment and the embankment is generally good. Thes require attention.

Based upon our hydraulics computations, the spillway capacity is 560 cubic feet per second which is equivalent to approximately 18 percent of the Test Flood. Based upon "Preliminary Guidance for Estimating Maximum Probable Discharges" dated March 1978, peak inflow to the reservoir is 3,840 cubic feet per second; peak outflow is 3,150 cubic feet per second with the dam overtopped 0.7 feet.

Utilizing the April 1978 "Rule of Thumb Guidance for Estimating Downstream Dam Failure Hydrographs," the peak failure outflow from the dam would be 5,900 cubic feet per second. The overtopping of 0.7 feet will flood the houses located immediately adjacent to the toe of the dam. A breach of the dam which would develop a 4 foot wave would create flooding immediately downstream of the dam causing severe damage to life and property.

b. Adequacy of Information - The information available is not sufficient to analyze the stability of the dam. An assessment of the dam must thus be based solely on a visual inspection, which cannot disclose all potential problems the dam may develop in the future.

c. Urgency - The recommendations and remedial measures presented in Sections 7.2 and 7.3 should be implemented within 6 months of the owner's receipt of this Phase I Inspection Report.

d. Need for Additional Information - There is a need for additional information.

7.2 Recommendations

1. Repair and reactivate the low level outlet and lower the pool elevation until spillway capacity has been increased.

2. A more sophisticated round the clock surveillance should be provided by the owner during periods of unusually heavy precipitation. The owner should develop a formal warning system with local officials for alerting downstream residents in case of emergency.

3. The spillway discharge capacity is not considered adequate. Further hydraulic studies by competent consulting engineers are necessary to determine what alternative measures are necessary to significantly increase spillway discharge capabilities.

4. The high level outlet valve is in the downstream face of the dam. It must be replaced by a valve on the upstream side of the high level outlet pipe. Also, the screen chambers for the outlets are not properly covered and are a hazard.

5. Since the worst operating experience recorded was a spillway jamming situation with three boats adrift, consideration should be given to raising the spillway bridge and/or providing a log boom.

7.3 Remedial Measures

a. Alternatives - This study has identified no practical alternatives to the above recommendations. The alternative which practically achieves the desired results as the recommendations would be to drain the lake. Such action should be taken in the interest of safety if the recommendations are not implemented within the specified time frame. However, this action would adversely impact the ecology of this lake and it's year-round recreational uses. Therefore, every effort should be made to implement the above recommendations.

b. Operation and Maintenance Procedures - The following measures must be undertaken within 6 months of the owner's receipt of this report and continued on a regular basis.

1. The trees and brush growing on the crest and brush growing on the upstream slope should be removed. Any tree stumps with a trunk diameter of 6 inches or over should also be removed and the hole backfilled with a compacted sandy clay or clayey sand soil. Along the undeveloped portion of the dam, trees should be removed

from the downstream slope of the dam and within a distance of 15 feet from the toe of the central portion of the original dam. Along those areas which have been developed, the removal of trees and brush should be within a distance of 30 feet from the upstream edge of the crest of the dam.

2. The top portion of the dam should be returned to its original grade and rip-rapped condition next to the spillway.

3. Obstructions should be removed from the outlet pipe.

   The bottom of the spillway should be cleaned of the branches and other debris, and trees immediately adjacent to the channel should be cut.

4. Maintain the low level outlet so the dam water level can be lowered for emergencies or maintenance. The valve should be operated at least twice a year for a minimum of 6 hours to clear the inlet and assure that the valve is operable.

5. The dam should be inspected at least once every two years by an inspector qualified in dam inspection.

APPENDIX

SECTION A: VISUAL OBSERVATIONS

VISUAL INSPECTION CHECK LIST

PARTY ORGANIZATION

PROJECT Lake Forest Dam

DATE: May 23, 1978

TIME: 8:30 - 3:00

WEATHER Partly Cloudy-80°F

W.S. ELEV. 174.9 **U.S.** 152 **DN.S**

PARTY:	INITIALS:	DISCIPLINE:
1. Dean Thomasson	DT	Structural
2. Hector Moreno	HM	Hydraulic/Hydrologic
3. Gonzalo Castro	GC	Geotechnical
4.		
5.		
6.		

PROJECT FEATURE	INSPECTED BY	REMARKS
1. Earth and Masonry Core Embankment	GC/DT	
2. Spillway	GC/DT	
3. Outlet Works - Inlets	GC/HM/DT	
4. Outlet Works - Conduits	GC	
5. Outlet Works - Control Structures	HM/DT	
6. Outlet Works - Outlets	GC/DT	
7. Outlet Works - Service Bridge	DT	
8. Reservoir	DT	
9. Operation and Maintenance	DT	
10. Safety and Performance Instrumentation	DT	
11.		
12.		

PERIODIC INSPECTION CHECK LIST

PROJECT Lake Forest DATE May 23, 1978

PROJECT FEATURE Earth and Masonry Core Dam Embankment

AREA EVALUATED	BY	CONDITION
Crest Elevation	DT	174.8
Current Pool Elevation	DT	174.9
Maximum Impoundment to Date	DT	178.0 (top of dam)
Surface Cracks	GC	None.
Pavement Condition	GC	No pavement, footpath, some grass, locally bushes and trees.
Movement or Settlement of Crest	GC	None apparent.
Lateral Movement	GC	None apparent.
Vertical Alignment	GC	Appears good.
Horizontal Alignment	GC	Appears good. Some modifications by homeowners with small retaining walls and boat landings.
Condition at Abutment and at Masonry Structures	GC	Some loss of soil next to spillway at upstream side.
Indications of Movement of Structural Items on Slopes	GC	None.
Trespassing of Slopes	GC	Footpaths on D.S. slope left of spillway.
Sloughing or Erosion of Slopes or Abutments	GC	None noted.
Rock Slope Protection - Riprap Failures	GC	Some minor movement of riprap.
Unusual Movement or Craking at or near Toes	GC	None observed.
Unusual Embankment or Downstream Seepage	GC	None observed.
Piping or Boils	GC	None observed.
Foundation Drainage Features	GC	None observed.
Toe Drains	GC	None apparent.

PERIODIC INSPECTION CHECK LIST

PROJECT Lake Forest DATE May 23, 1978

PROJECT FEATURE Earth and Masonry Core Dam Embankment

AREA EVALUATED	BY	CONDITION
Vegetation growth	GC	Trees growing on top of dam at several locations,
Instrumentation Systems	GC	None known.

PERIODIC INSPECTION CHECK LIST

PROJECT Lake Forest DATE May 23, 1978

PROJECT FEATURE Spillway - Approach, Channel, Weir, Discharge Channel

AREA EVALUATED	BY	CONDITION
a. Approach Channel	GC	None observed because reservoir was full.
General Condition	—	
Loose Rock Overhanging Channel	—	
Trees Overhanging Channel	-	
Floor of Approach Channel	-	
b. Weir and Training or Sidewalls	-	
General Condition of Concrete	DT	Concrete fair - Masonry side walls loosing mortar.
Rust of Staining	DT	No.
Spalling	DT	Erosion at crest of weir.
Any Visible Reinforcing	DT	No.
Any Seepage or Efflorescence	DT	No.
Drain Holes	GC	None.
c. Discharge Channel		
General Condition	GC	Good.
Loose Rock Overhanging Channel	GC	None.
Trees Overhanging Channel	GC	Tree branches fallen and other branches leaning.
Floor of Channel	GC	Stone, with some assorted debris in addition to tree branches.
Other Obstructions	GC	None.

PERIODIC INSPECTION CHECK LIST

PROJECT Lake Forest DATE May 23, 1978

PROJECT FEATURE Outlet Works - Inlet Channel & Inlet Structure

AREA EVALUATED	BY	CONDITION
a. Approach Channel	GC	Could not be observed if present. Reservoir was full.
Slope Conditions		
Bottom Conditions		
Rock Slides or Falls		
Log Boom		
Debris		
Condition of Concrete Lining		
Drains or Weep Holes		
b. Intake Structure		
Condition of Concrete	DT & HM	Low level intake structure flooded and inoperative. High level intake in good condition.
Stop Logs and Slots		

PERIODIC INSPECTION CHECK LIST

PROJECT Lake Forest DATE May 23, 1978

PROJECT FEATURE Outlet Works - Transition and Conduit

AREA EVALUATED	BY	CONDITION
General Condition of Concrete	-	
Rust or Staining on Concrete	-	
Spalling	-	
Erosion or Cavitation	-	
Cracking	-	
Alignment of Monoliths	-	
Alignment of Joints	-	
Numbering of Monoliths	-	
Conduits	GC	Outlet conduit is blocked at outlet to about its mid height.

PERIODIC INSPECTION CHECK LIST

PROJECT Lake Forest DATE May 23, 1978

PROJECT FEATURE Outlet Works - Control Tower, Operating House, Gate Shafts

AREA EVALUATED	BY	CONDITION
a. Concrete and Structural		
General Condition	DT	Low level intake in poor condition. High level intake in good condition.
Condition of Joints	DT	Good.
Spalling	DT	Yes.
Visible Reinforcing	DT	None.
Rusting or Staining of Concrete	DT	None.
Any Seepage or Efflorescence	DT	None.
Joint Alignment	DT	Good.
Unusual Seepage or Leaks in Gate Chamber	DT	None.
Cracks	DT	None.
Rusting or Corrosion of Steel	DT	None.
b. Mechanical and Electrical	HM	No mechanical or electrical equipment other than gate valves. Lower level gate valve inoperable. High level gate valve and crossover valve in manhole in good condition.
Air Vents		
Float Wells		
Crane Hoist		
Elevator		
Hydraulic System		
Service Gates		
Emergency Gates		
Lighting Protection System		
Emergency Power System		

PERIODIC INSPECTION CHECK LIST

PROJECT Lake Forest DATE May 23, 1978

PROJECT FEATURE Outlet Works - Control Tower, Operating House, Gate Shafts

AREA EVALUATED	BY	CONDITION
Wiring and Lighting System in Gate Chamber	-	

PERIODIC INSPECTION CHECK LIST

PROJECT Lake Forest DATE May 23, 1978

PROJECT FEATURE Outlet Works - Outlet Structure and Outlet Channel

AREA EVALUATED	BY	CONDITION
General Condition of Concrete	DT	Good.
Rust or Staining	DT	None.
Spalling	DT	Slight.
Erosion or Cavitation	DT	Slight.
Visible Reinforcing	DT	None.
Any Seepage orEfflorescence	DT	None.
Condition at Joints	DT	Good.
Drain Holes	GC	None.
Channel	GC	Stone walls and stone bottom. In good condition except for left wall near spillway which has partly collapsed.
Loose Rock or Trees Overhanging Channel	GC	Several tree branches have fallen and others are leaning over channel.
Condition of Discharge Channel	GC	Contains some debris.

PERIODIC INSPECTION CHECK LIST

PROJECT Lake Forest **DATE** May 23, 1978

PROJECT FEATURE Outlet Works - Service Bridge (Pedestrian/Vehicular)

AREA EVALUATED	BY	CONDITION
a. Super Structure	DT	Steel channel with steel grating for pedestrian access.
Bearings		
Anchor Bolts		
Bridge Seat		
Longitudinal Members		
Under Side of Deck		
Secondary Bracing		
Deck		
Drainage System		
Railings		
Expansion Joints		
Paint	DT	Needs paint.
b. Abutment & Piers	DT	Steel pipe concrete filled pier at center of bridge. Rubble masonry abutments.
General Condition of Concrete		
Alignment of Abutment		
Approach to Bridge		
Condition of Seat & Backwall		

PERIODIC INSPECTION CHECK LIST

PROJECT Lake Forest **DATE** May 23, 1978

PROJECT FEATURE Reservoir

AREA EVALUATED	BY	CONDITION
Shoreline	DT	Fully developed
Sedimentation	DT	Slight at storm drainage inlet and beaches.
Potential Upstream Hazard Areas	DT	None, Dam would overtop first.
Watershed Alteration - Runoff Potential	DT	Area largely developed, only minor watershed alteration possible.

PERIODIC INSPECTION CHECK LIST

PROJECT Lake Forest **DATE** May 23, 1978

PROJECT FEATURE Operation and Maintenance

AREA EVALUATED	BY	CONDITION
a. Reservoir Regulation Plan		
Normal Conditions	DT	In fall water level maintained 3 feet below
Emergency Plans	DT	Spillway.
Warning System	DT	Notifies Fire Department.
b. Maintenance (Type) (Regularity)		
Dam	DT	Remove trees and brush every two (2) to three (3) years.
Spillway	DT	Clean as needed.
Outlet Works	DT	Valves greased as needed.

PERIODIC INSPECTION CHECK LIST

PROJECT Lake Forest **DATE** May 23, 1978

PROJECT FEATURE Safety and Performance Instrumentation

AREA EVALUATED	BY	CONDITION
Headwater and Tailwater Gages	DT	None.
Horizontal and Vertical Alignment Instrumentation (Concrete Structures)	DT	None.
Horizontal and Vertical Movement, Consolidation, and Pore-Water Pressure Instrumentation (Embankment Structures)	DT	None.
Uplift Instrumentation	DT	None.
Drainage System Instrumentation	DT	None.
Seismic Instrumentation	DT	None.

APPENDIX
SECTION B: EXISTING DATA

SPECIAL NOTE

SECTION B

AVAILABILITY OF DATA

The correspondence listed in the Summary of Contents and the plans listed in the Table of Contents, Appendix Section B, are included in the master copy of this report, which is on file at the office of the Army Corps of Engineers, New England Division, in Waltham, Massachusetts.

Only the following correspondence is included in this report.

SECTION B: EXISTING DATA

SUMMARY OF CONTENTS

SECTION B: EXISTING DATA

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SECTION B: EXISTING DATA

SUMMARY OF CONTENTS

No. ____

WATER RESOURCES COMMISSION
SUPERVISION OF DAMS
INVENTORY DATA

Long 73-12.5
LAT 41-13.1

Inventoried By WPS

Date 7 JULY 1964

Name of Dam or Pond LAKE FOREST

Code No. PQ 2.2 IS 2.5

Nearest Street Location LAKESHORE TERRACE

Town BRIDGEPORT

U.S.G.S. Quad. BRIDGEPORT

Name of Stream ISLAND BROOK

Owner ____

Address ____

1899

Pond Used For RECREATION

Dimensions of Pond: Width 1500 FEET Length 1500 FEET Area ~~56 ACRES~~ 71A

Total Length of Dam 1686 FEET Length of Spillway 36 FEET

Location of Spillway EAST END OF DAM

Height of Pond Above Stream Bed 30 FEET

Height of Embankment Above Spillway 4 FEET

Type of Spillway Construction CONCRETE

Type of Dike Construction EARTH

Downstream Conditions RESIDENTIAL AREA

Summary of File Data ____

Remarks THIS IS A MAJOR STRUCTURE

Would Failure Cause Damage? YES Class B

B-1

TO	AGENCY	DATE
Stephen C. Thomson Director	Environmental Protection Water and Related Resources	March 22, 1972
FROM	**AGENCY**	**TELEPHONE**
William H. O'Brien III Civil Engineer	Environmental Protection Water and Related Resources	

SUBJECT File Summary - Lake Forest Dam, Bridgeport

✓ 7-7-64 Dam was inspected as part of inventory program. No structural defects in evidence.

✓ 3-16-66 WRC requested a routine inspection by our consultant, J. Cone.

✓ 6-7-66 Report from consultant (Cone). States opinion that Q (design inflow) should be at 4,000 CFS.

✓ 7-13-66 Letter from WRC to L. F. Assoc. enumerating recommendations and request that they hire a consulting engineer.

9-27-66 Letter from WRC to L. F. Assoc. - unless we receive answer by October 10, will consider more formal action.

10-10-66 Letter from Sedensky & Meyer (L. F. Lawyer) that trees had been cut down and balance of work to be completed in 2 weeks.

10-17-66 Letter from WRC to lawyer - what are plans to provide additional spillway capacity?

✓ 2-10-69 Report from our engineering consultant, John Luchs, stating that there is 38" from the spillway (normal pond) to the underside of a steel footbridge across spillway (same elev. as top of dam) and that the depth of water through this spillway would have to be 47 inches to pass the run-off from a rainfall approximating that recorded in the Diane storm (Aug. 18, 1955) the rainfall recorded at the Bridgeport Airport in this storm did not come anywhere near the maximum.

✓ 2-19-69 - Owner should be responsible to repair or remove dam.

2-20-69 Memo to file from W. O'Brien summarizing meeting at the Assoc.'s Clubhouse on 3/19/69 with their President, Secretary and seven members of their board of directors and our engineering consultant, John Luchs, at which time there appeared general agreement that engineering plans should be submitted for approval for repair of dam.

4-17-69 Letter received from R. J. Battistelli, a member of the Lake Forest Assoc. describing instance where 3 boats were adrift and blocked the spillway so that water started to cut through the earth on top of the dam. Possible disaster averted by member who happened to notice this at 2:00 a.m.

4-28-69 Letter from Battistelli suggesting increasing the length of the spillway by at least 20 feet. (Based on an engineering study the approved plans call for maintaining the existing 36 foot length spillway and adding an adjacent additional 100 feet of spillway at an elevation 0.7 feet below the existing.) Mentions that high water levels threaten basement floors. (Proposed changes will mean lower water levels at normal and at flood time).

5-8-69 Letter from Secretary of Assoc. that Blair Assoc. is their engineer but work-load prohibits starting for 2 to 3 months. Request extension of 3 months.

5-21-69 Letter from W. O'Brien to Assoc. - Per VOTE of WRC, submission of plans extended to July 14, 1969, completion date remains the same (September 1, 1969). Requests that their engineer will inform us as to when plans will be submitted.

6-9-69 Copy of letter from Assoc. to Blair Assoc. authorizing them to prepare plans.

8-12-69 Letter from Attorney Jonas J. Meyer III, legal counsel and member of the board. Board was "shocked" that Blair Assoc. had not submitted plans. Requests names of "alleged members". Disagrees with their comments. Let me know if you don't receive plans immediately.

11-7-69 Letter from Frank Ragaini of Clarence Blair - We expect to submit plans to your office by December 15.

2-2-70 Copy of letter from Clarence Blair Assoc. to our Consultant John Luchs inquiring if their design criteria are acceptable.

4-20-70 Letter from Attorney Jonas Meyer requesting authorization to change new spillway from west to east of existing spillway.

4-27-20 Letter from W. O'Brien to Assoc. stating that the ORDER of the WRC did not mean to imply that the additional spillway had to be provided to the west. How to provide adequate capacity is to be worked out between your engineer and your Assoc. When will plans be submitted?

5-25-70 Letter from W. O'Brien to Jonas Meyer - When will plans be submitted?

5-29-70 Copy of letter from Assoc. to Clarence Blair - at Meeting of Board of Directors on May 27, I was instructed to request you to provide the additional spillway to the EAST of the existing spillway. "This is your authority to commence work".

7-28-70 Engineering report from Clarence Blair asking our concurrence with their criteria for spillway design.

some correspondence and conferences in interim

12-14-70 Letter from John Luchs suggesting using higher rainfall of 15.5 inches in 6 hours instead of 10.3 inches because to provide for this, the spillway would remain essentially the same and would require raising the embankment 1.5 feet instead of 0.9 feet.

12-18-70 Luch's comments forwarded to Clarence Blair Assoc.

4-14-71 Plans sent to us by Clarence Blair rec'd April 15, 1971.

4-15-71 Plans hand carried to Luchs requesting his comments by April 16, 1971.

4-26-71 WRC votes to issue Construction Permit when revised plans are submitted in agreement with telephone conversation with Luchs and Us and Clarence Blair Assoc.

5-18-71 Clarence Blair Assoc. submits revised plans.

5-24-71 Letter from Lake Assoc. asking many questions.

5-27-71 John Luchs recommends approval of revised plans.

6-9-71 Letter from W. O'Brien to Lake Assoc. answering questions.

6-14-71 Construction Permit for repairs to dam issued to the Lake Forest Assoc. Inc., Permit to expire unless work is started within six months and completed within one year.

6-14-71 Letter to Attorney Jonas J. Meyer III from John Curry, Director requesting that the Commission be notified in writing before July 1, 1971 of the proposed time schedule of repairs. There is no record in our file that this letter was ever answered.

7-19-71 Record rainfall in Bridgeport , 5.7 inches in 4 hours, recorded at Bridgeport Municipal Airport. The center of the drainage area for this dam is ½ way between 2 rain gauges maintained by Bridgeport Hydraulic which recorded totals of 1.84" and 1.28" for July 19, 1971. If the center of this storm had been miles further inland, the dam as it now exists, could have been overtopped and if so, would have presumeably failed.

7-29-71 Certified letter to Assoc. from John Curry, Director (return receipt was returned signed by Secretary of Lake Assoc.) requesting name and address of new president and detailed time schedule for making repairs. No answer has been received to this letter.

In this interim we had a conference in the Assistant Attorney General's Office and were told that we would have to wait for the expiration of the Construction Permit before taking further action.

12-20-71 Memo to file from W. O'Brien regarding field inspection of dam on December 16, 1971. No work accomplished - therefore permit has expired.

1-3-72 Interdepartment memo from Commissioner Lufkin to Robert Killian, Attorney General requesting that he take immediate legal steps to secure repair or removal of dam in accordance with ORDER of WRC issued February 19, 1969.

2-24-72 Copy of letter from Robert Killian, Attorney General to Judge Albert L. Coles, representing the lake assoc. suggesting that W. O'Brien contact him to set up a meeting.

3-1-72 Undersigned spoke to Judge Coles. He said he felt that the state should not delay in its proceedings and that he would try to convince the assoc. that they should do something. Conversation relayed to Brian O'Neill, Assistant Attorney General.

Estimated cost of repairs per approved plans is $80,000 to $90,000 per owner's engineer.*

Responsibility of dam owner is to insure the safety of his dam which includes the provision of an adequate spillway. We will plan to inspect other structures below to check their adequacy. If necessary, the owners will be advised accordingly. This is not a consideration in this case.

W. A. O'Brien
Civil Engineer

WHO:d

*John Lucks estimates $60,000 - 3/23/72

NEW YORK LICENSE 4755
CONNECTICUT REGISTRATION 4

JOSEPH W. CONE
CIVIL ENGINEER
124 HAVEMEYER PLACE
GREENWICH, CONNECTICUT
06830

TELEPHONE
TOWNSEND 9-21

Mr. William H. O'Brien III
Water Resources Commission
State Office Building
Hartford 15, Conn.

Re: Dam #45 Lake Forest-Bridgeport

Dear Mr. O'Brien:

The Lake Forest earth dam was inspected by me on May 7, 1966, also a considerable portion of the watershed was traversed. The general situation was evidently so startling that considerable more time was used in this investigation than is normally required.

Reference is made to Plates 1-8 incl., work sheets A-I incl., photos 1-4 incl., for supporting details so that this letter report may be comparatively brief.

Watershed is 1.445 sq. mi., is approx 2 mi x 0.7 mi. Land use is generally rather small suburban lots, is developing rapidly and will be intensely developed by 2000 A.D.

Terrain is gentle to hilly rolling, mostly residential.

Drainage. Area is served by many small streams, in addition to storm water sewers in the more densely built up sections, with paved streets and other impervious surfaces. For these reasons the runoff and concentration factors may be characterized as medium high at present and high by 2000 AD, although terrain is not rugged.

Land Use. Land is developed in small lots below the dam and around the lake, in appearance a part of the City of Bridgeport.

NEW YORK LICENSE 4755
CONNECTICUT REGISTRATION 4

JOSEPH W. CONE
CIVIL ENGINEER
124 HAVEMEYER PLACE
GREENWICH, CONNECTICUT

TELEPHONE
TOWNSEND 9-2

Should the dam breach without warning property damage would be very high and undoubtedly many lives would be lost.

Dam is of earth with mortar faced dry masonry core-wall approximately on center line, and possibly there may be another core-wall, both as shown on 1899 drawing which you have in your files. Sketch sections of dam and spillway were taken on May 7th and shown on PL-3.

Trees and Shrubs are growing all over the dam embankment, as shown by photos. In addition, a path is on dam crest and several paths up downstream face are worn to bare earth.

Spillway. As shown on PL-3, maximum dimensions of spill-notch are 35.5' by 3.25', and 1.75' of height is obstructed by a wire screen supported by pipe posts and top rail, this shows in Photo #1. Spillcrest to damcrest of only 3.25' does not allow much freeboard for wave height and runup. On May 7th there was some accumulation of leaves and debris lodged against the screen. If spillway were clear it would be inadequate to pass peak flood for a slow runoff shed (PL-8) and this shed definitely is not slow.

Maintenance. It is evident that there has been a reprehensible lack of knowledgeable maintenance for many years.

Precipitation. I was unable to learn to what height above spillcrest water reached during October 1955 storm. By referring to PL-2, precipitation in the Bridgeport area was not extraordinary and did not approach that in the Stamford-Norwalk

NEW YORK LICENSE 4755
CONNECTICUT REGISTRATION 4

JOSEPH W. CONE
CIVIL ENGINEER
124 HAVEMEYER PLACE
GREENWICH, CONNECTICUT

TELEPHONE
TOWNSEND 9-21

areas.

Also it should be noted that after 2.7" in 4 hrs. in AM of Oct. 15th, only 1.24" fell in 17 hrs. in AM-PM Oct. 15th. This lag in precipitation allowed spillway to pass storage build-up in reservoir in time to take runoff midnight 15th-16th.

In short, the Oct. 1955 was no serious tost particularly if one compares with "Probable Maximum Possible" (PL-5). It was most fortunate that in this area the storm did not reach 15" and that characteristics were more compact without long periods of low rainfall. Had this occurred, the dam would have failed.

Design Q. Since there would be a high potential of property damage and loss of life should this dam fail, many methods for estimating runoff were calculated as shown on work sheets. Results are summarized as follows:

		Pres-100 yr	4000	
PL-4	Design of recent earth dams			400 yr
Pl-7 & A	Public Roads formula	(1220)	3240	2000 AD
E	Cook Method	(2160)	4550	"
D	Rational Method	(2250)	4750	"
PL-6	Q 1955 = 3000 $\sqrt{1.445}$		3600	
G	Cir #4 Public Roads		3960	"
			6 / 24,100	
	Average Q =		4,000 cfs	"

B-21

It is my opinion that Q should be at least 4000 cfs when one considers a built up city just below an earth dam, which of course should never be overtopped.

New Spillway. Required capacity may be provided by:

(1) Raising Dam

(2) Wider Spillway

(3) Lower Spillway

(4) Various Combinations

(1) I examined the south shore of the lake at several places but did not take levels. I do not believe it practical to raise the dam because it would (a) put extra pressure on the earth dam and (b) there are probably low spots along the shore.

(2) A wider spillway seems more practical and safer.

(3) If spillway is lowered it could only be by a small amount.

(4) A combination might be lower spillway and widen same.

Seepage. No seepage was noticed at the areas either side of the spillway. However there is a small flow at the end of Victory Street that is piped from the direction of the lake. This flow should be watched.

Recommendation. In my opinion owners of dam and spillway should be notified to:

CIVIL ENGINEER
124 HAVEMEYER PLACE
GREENWICH, CONNECTICUT
TOWNSEND 9-2

(1) Remove trees and shrubs from earth embankment.

(2) Obtain good protective stand of grass on embankment.

(3) Remove screen on spillway.

(4) Retain professional engineer, particularly competent in the determination of flood flows and design of earth dams and spillways.

(5) Submit plans for approval.

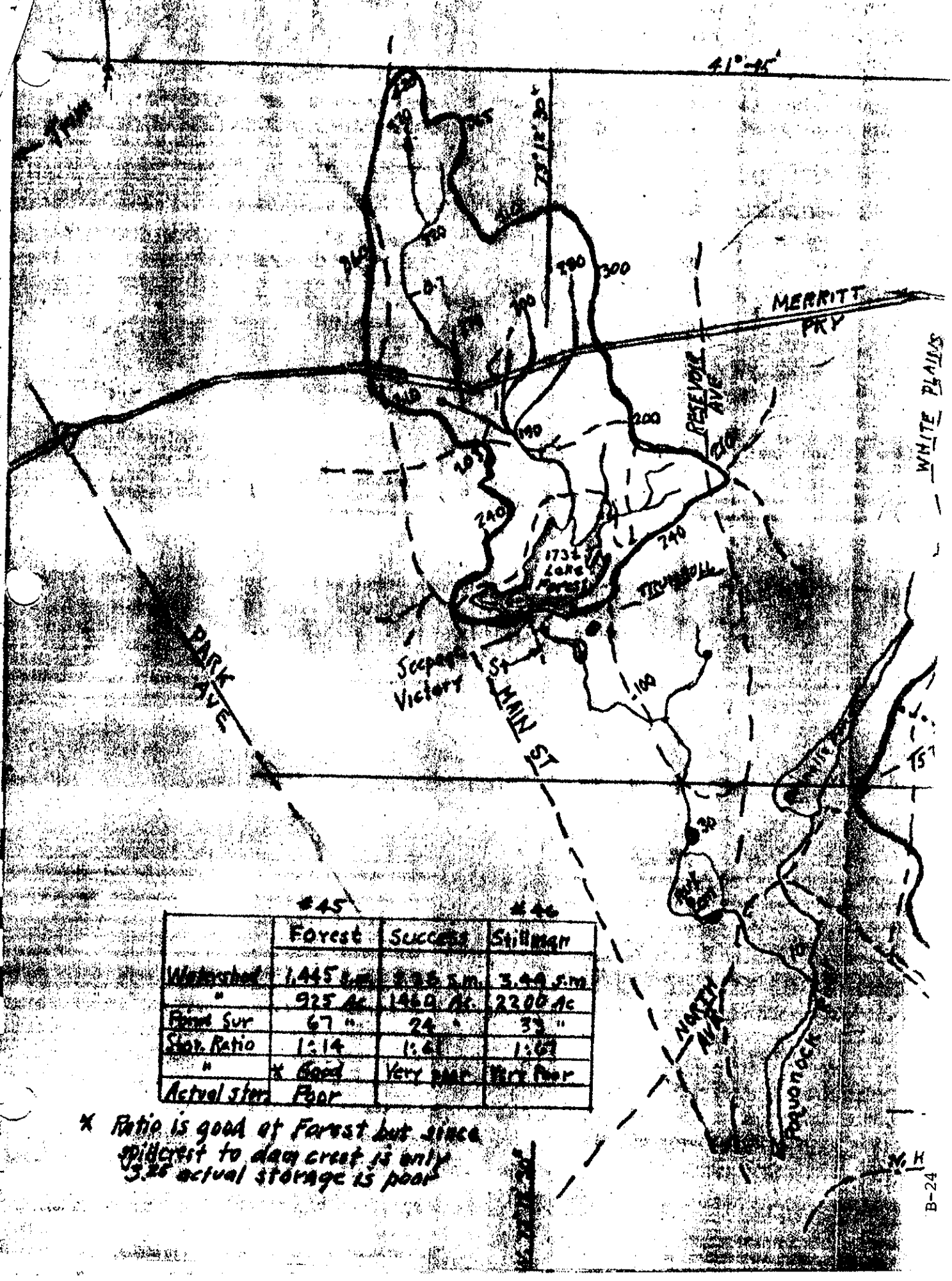
I would comment again, it is most fortunate that Bridgeport to date has been spared a serious catastrophe. Don't tempt the forces of nature too often.

Yours very truly,

J. W. Cone

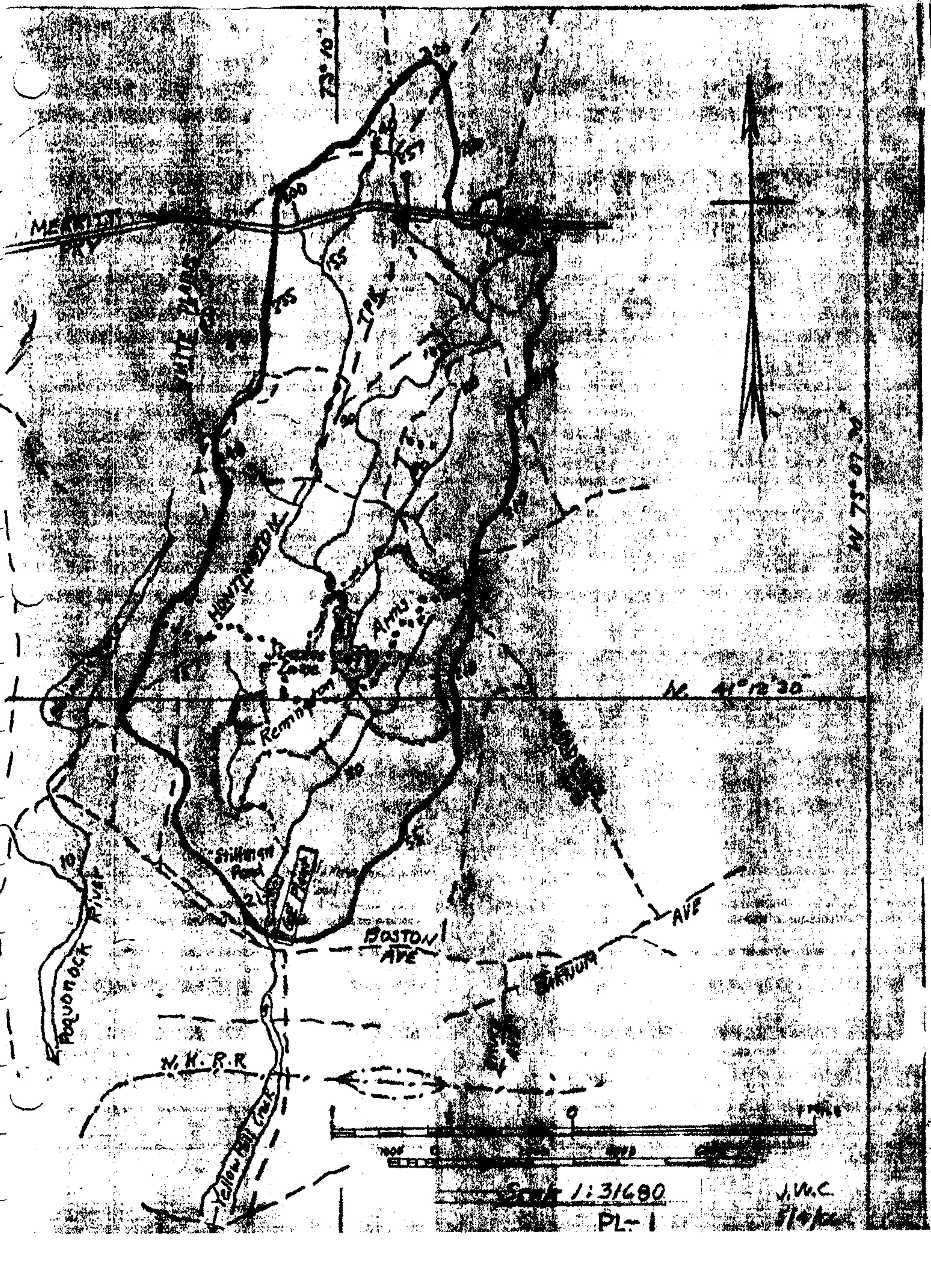
JWC/dr
Enc: - many

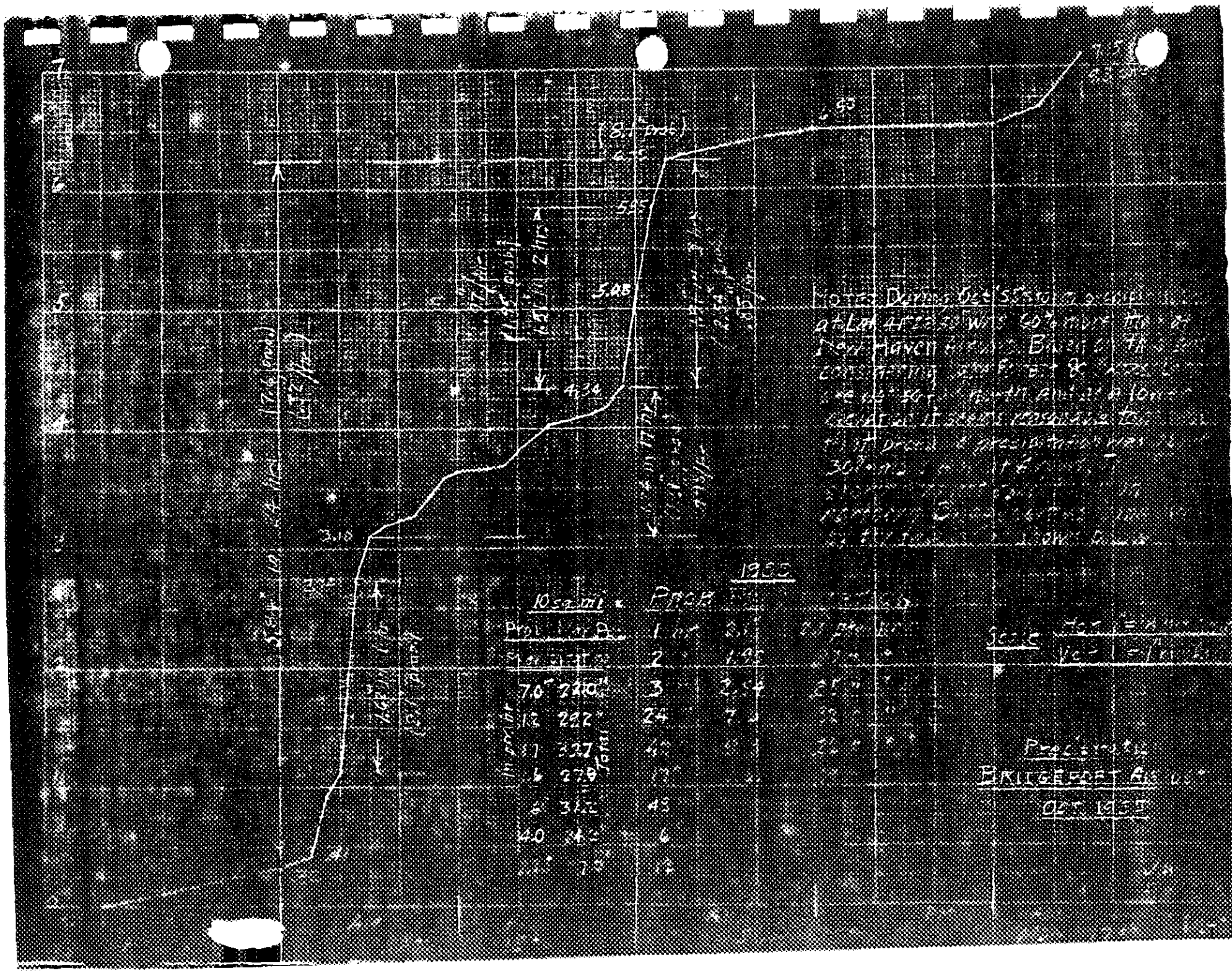
B-23

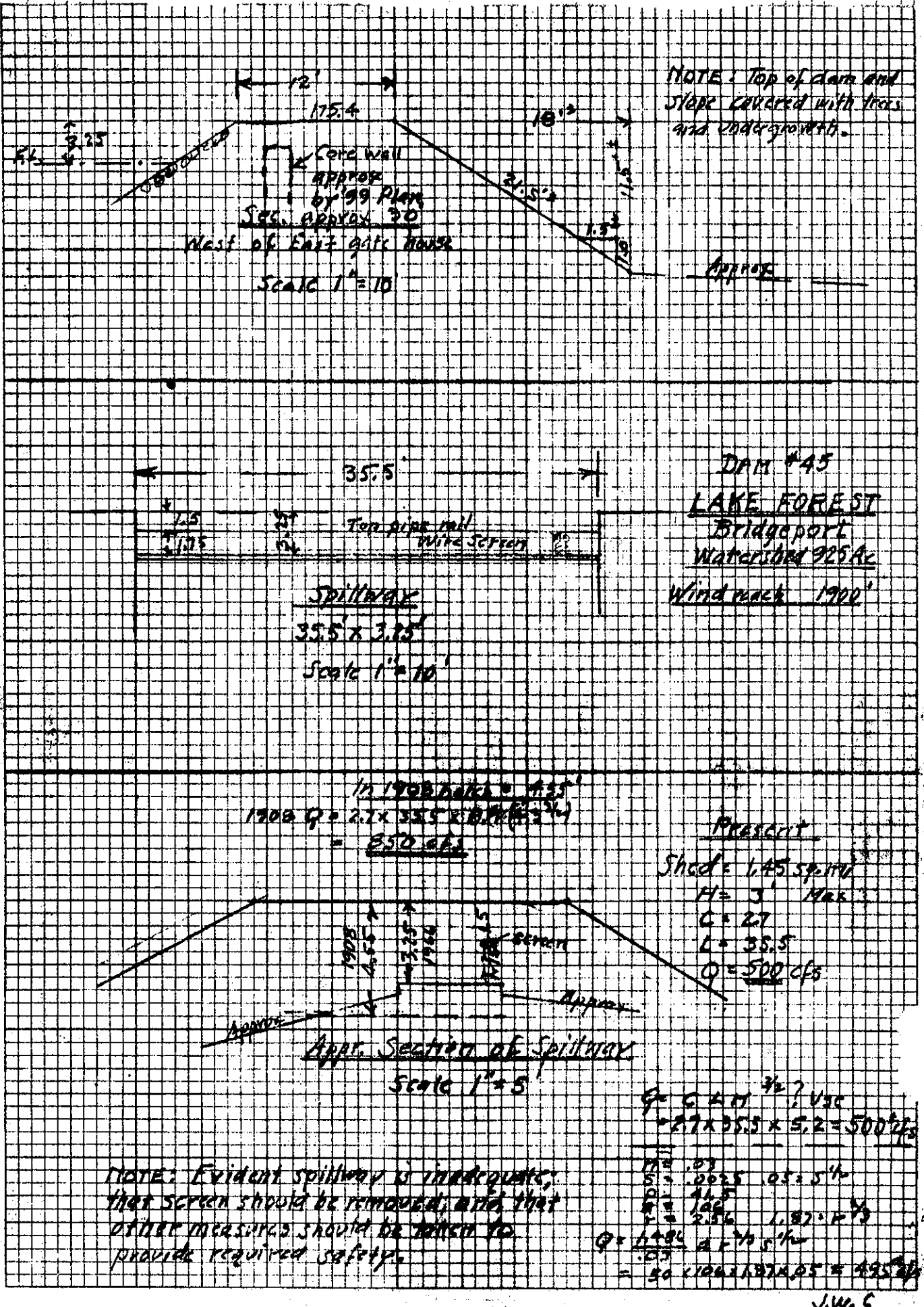


	#45 Forest	#46 Success	Stillman
Watershed	1,445 s.m.	2.26 s.m.	3.44 s.m.
"	925 Ac.	1460 Ac.	2200 Ac.
Forest Cur	67 "	24 "	33 "
Stor. Ratio	1:14	1:61	1:67
"	* Good	Very poor	Very Poor
Actual Stor.	Poor		

* Ratio is good at Forest but since spillcrest to dam crest is only 3.25 actual storage is poor


MERRITT PKY
HUNTINGTON TPK
Remington
Stillman Pond
BOSTON AVE
BARNUM AVE
N. H. R. R.
Yellow Mill Creek
Pequonock River
Scale 1:31680
J.W.C.
PL-1

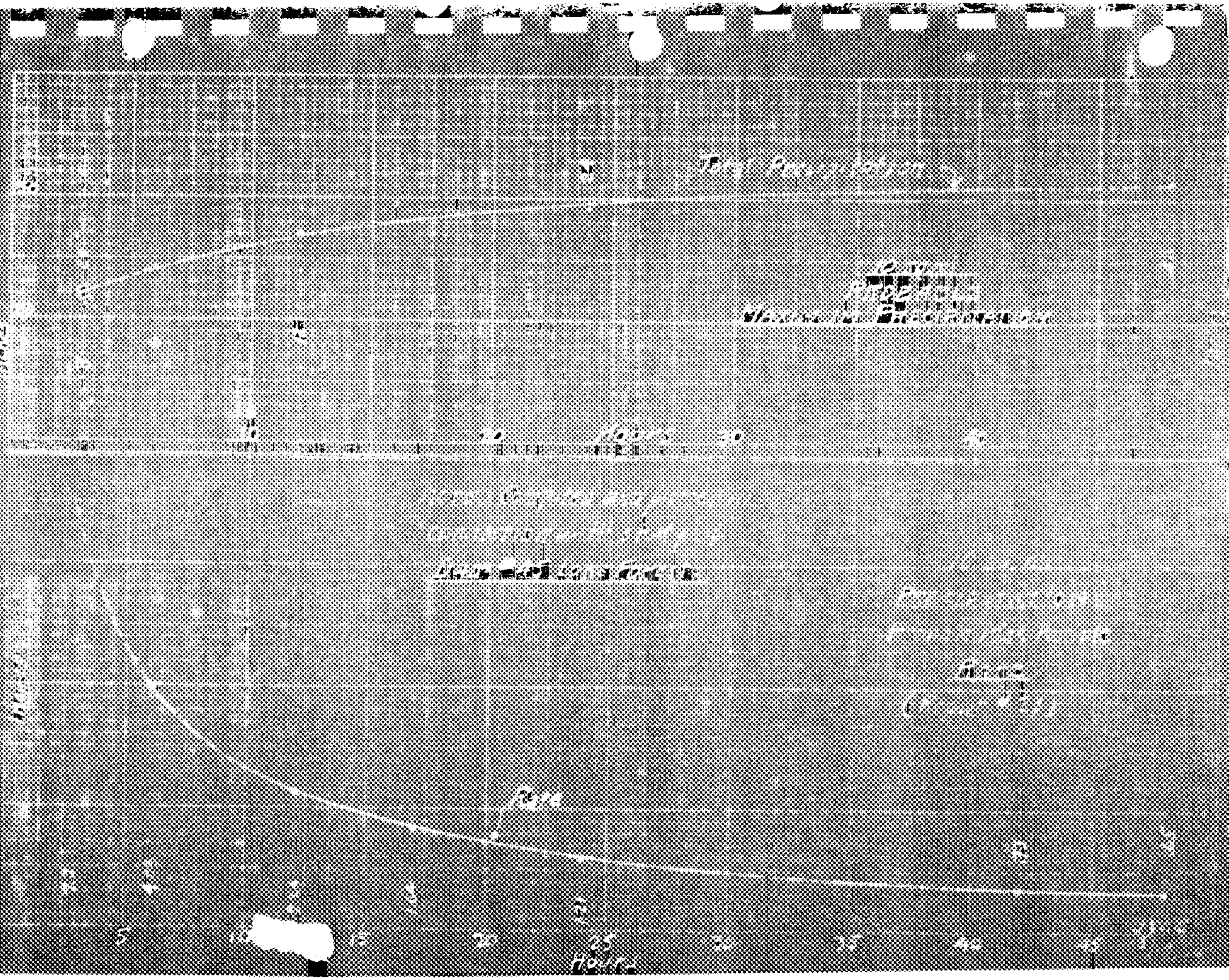

5.05
4.34
3.10
1953



B-27

J.W.C
5/10/66

PL-3



10 prints
this side
letter size

SEVENTY-SECOND ANNUAL REPORT

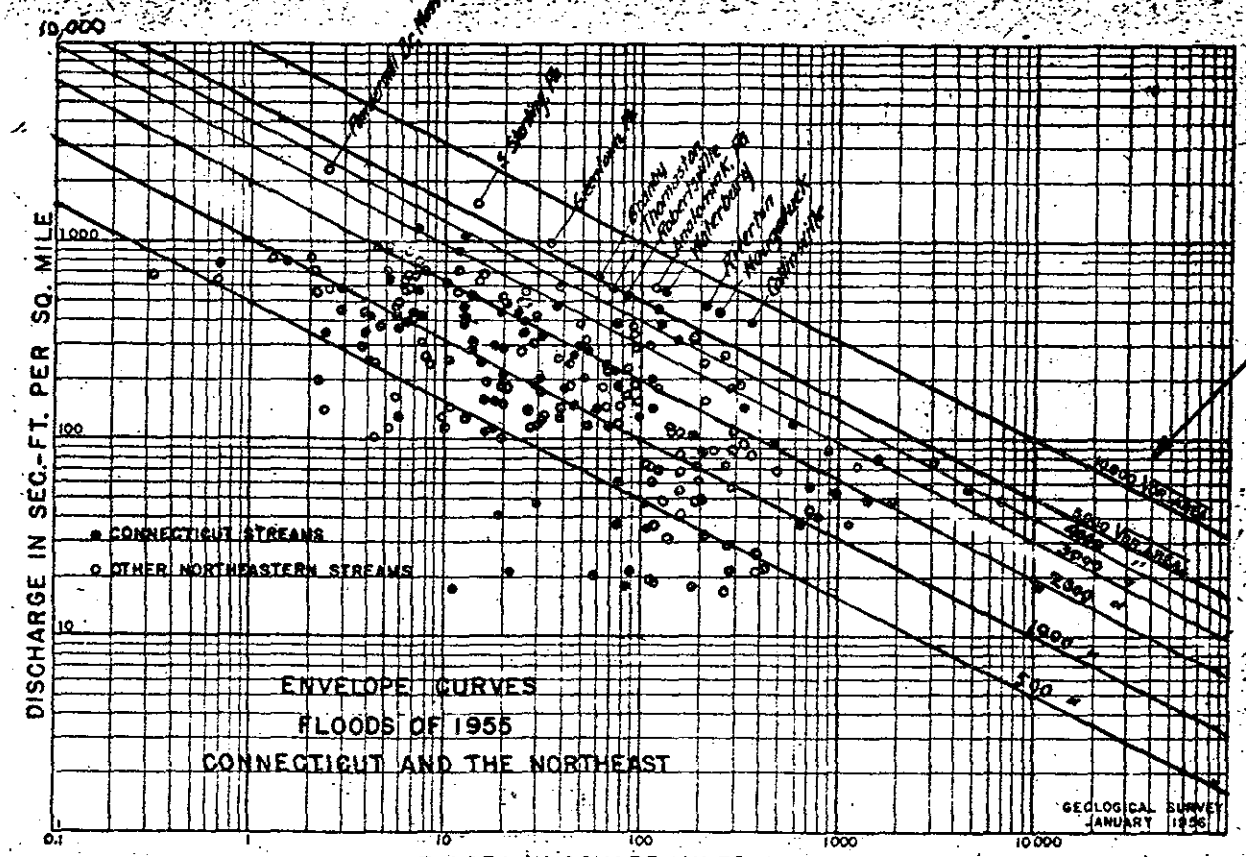
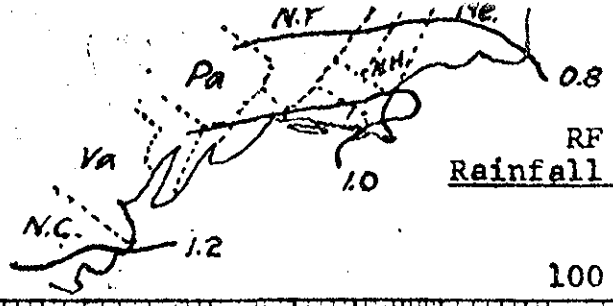


FIGURE 5

Conn Soc of C.E. 1956 Annual Report p.84

84

9-7d.



RF
Rainfall Factor

1000 100 300 1 - Sq.Mi.

$Q_{design} = RF \times LF \times FF \times Q$

For Greenwich RF = 1.0
" Conn., " = 1.0 average

NOTE: This graph based on chart 1021.10 Bureau Public Roads
* - Additions by Cone
* LF factor should be based on estimated land use 50 years in the future

Peak Runoff in C.F.S.

$Q = 9A^{0.6}$

THIS GRAPH
FF Frequency - 1.0
RF Rainfall Factor - 1.0
LF Mixed Cover Steep - 1.0

Land Use and Slope Factors (LF)

Lots *	Land Slope	Steep over 2%	Flat 0.2%	Very flat no ponds
Small	100% Cultivated (row crops)	1.2	0.8	0.25
1-Acre	Mixed cover	1.0	0.6	0.2
4-Acre	Pasture	0.6	0.4	0.1
	Woods, deep forest litter	0.3	0.2	0.05

Frequency Factors (FF)

Frequency, years	5	10	25	50	100	200	400
Factor	0.6	0.8	1.0	1.2	1.4		
Conn. Formula *	0.5	0.7	1.0	1.4	1.6	2.5	3.6

"A"
25 YR
PEAK RUNOFF
Small Watersheds

Watershed in Acres

2 3 4 5 6 7 8 9 10 2 3 4 5 6 7 8 9 100 2 300 4 5 6 7 8 9 1000

* Examples
100 Acres, small lots, 0.5% slope, design 100 yrs.
R.F. L.F. F.F. Q
Q_{100} = 1.0 x 0.9 x 1.4 x 195 = 246 c.f.s.
500 Acres, woods & pasture, steep, design 100 yrs.
Q_{100} = 1.0 x 0.6 x 1.4 x 580 = 487 c.f.s.

J. W. Cone
Oct. 1963
Rev. Apr. 1965
Sheet 1 of 3

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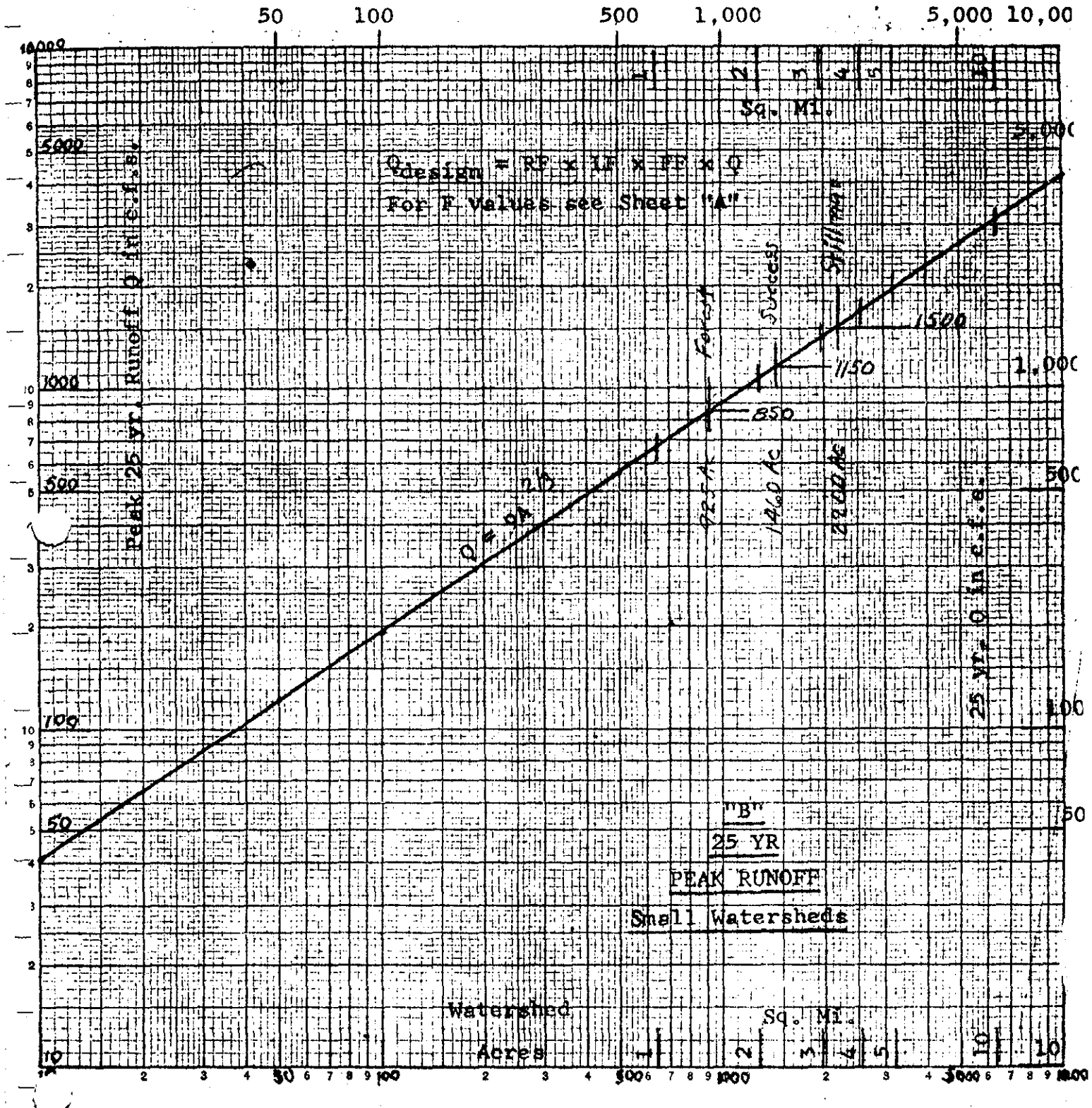


J. W. Cone
March 1965

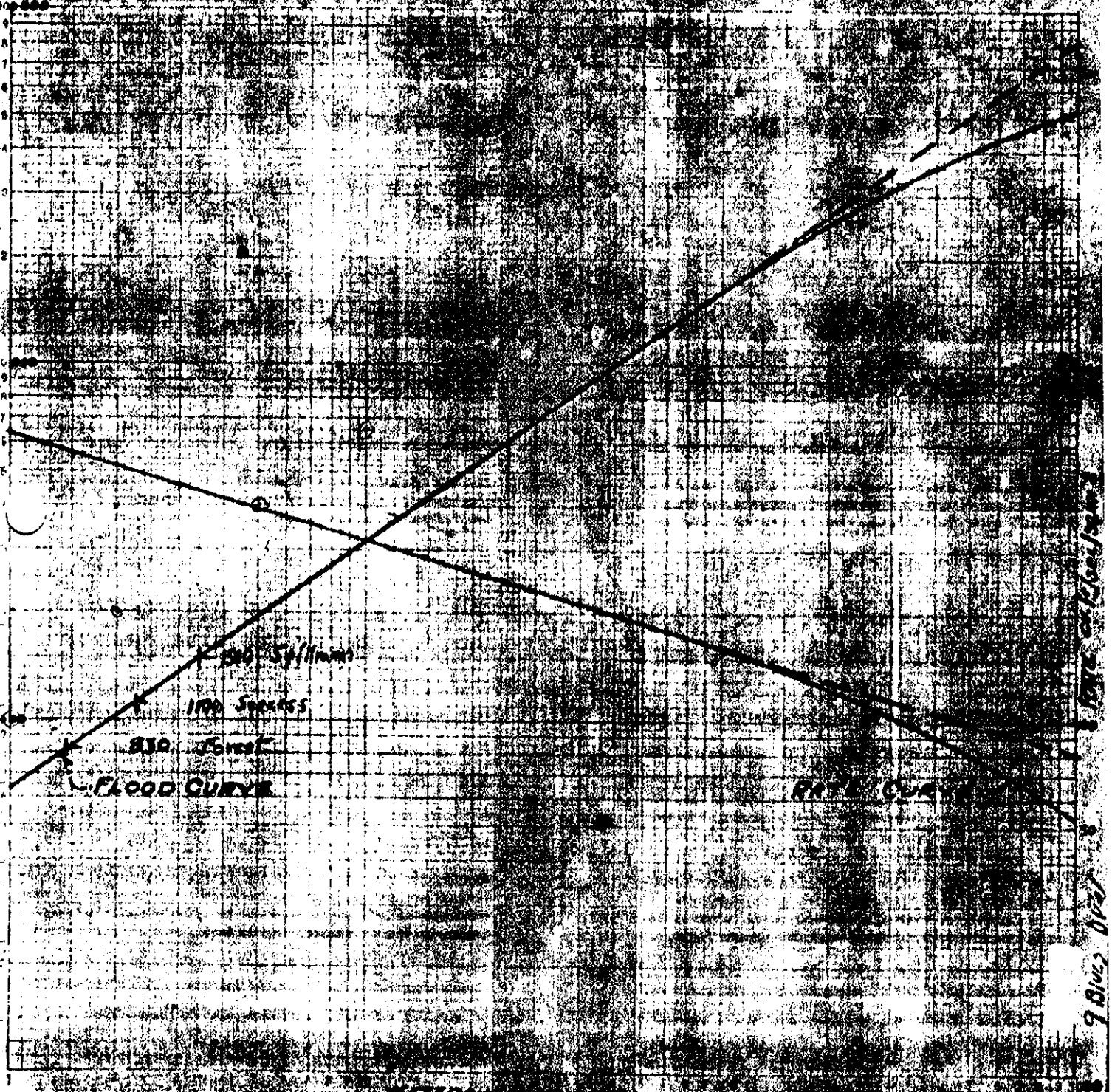
Sheet 2 of 3

B-32

PL-76.

Flood Chart

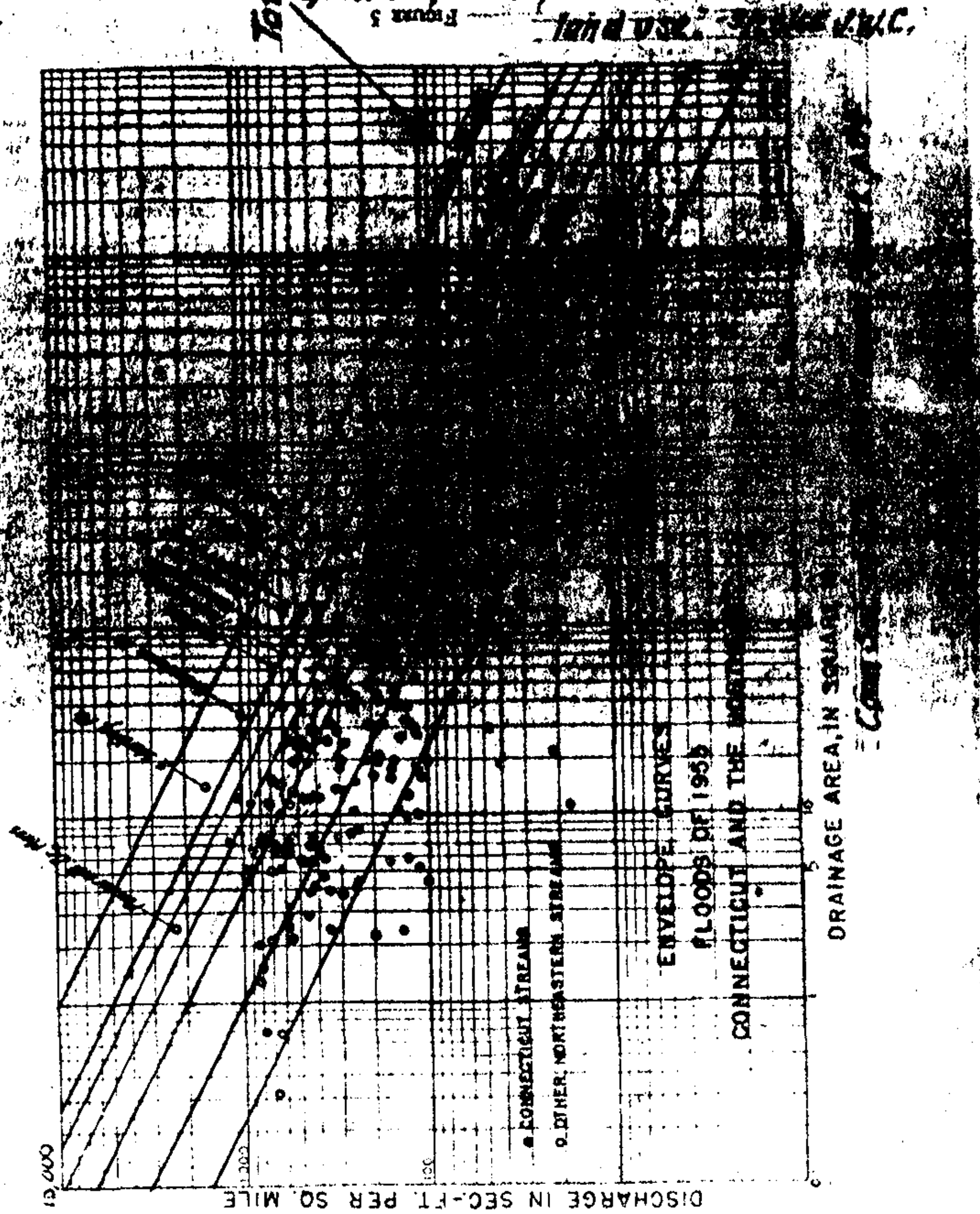
For Slow Run-off Watersheds



WATERSH

TION. This flood curve is sugge use in spillway design to pass maximum floods from slow run-off watersheds only. Judgement based on experience must be exercised when using this chart. Sufficient freeboard must be provided above still water h ring floods to provide the factor of safety required by local cond Freeboard is of vital importance in the case of earth dams and dikes.

NOTE: These curves are based on actual flows during 1955 floods and can be exceeded since precipitation nowhere reached maximum possible. Also there was a paucity of data on small watersheds, and greater future flows with more intense land use.



PL-9

By Public Roads Graphs

FOREST 925 Ac — 1.445 sq. mi. $\sqrt{1.445} = 1.2$

(Chart B) $Q_{25\text{yr Normal}}$ Peak = 850 cfs Wind reads 1900' (Constant 1.08)

Entire shed developing rapidly. Rolling terrain

			cfs/Ac
Q present 25yr.	= RF × LnF × FF × Q		
	= 1 × 0.8 × 1 × 850	= 680 cfs	0.73
Q " 100yr	= 1 × 0.8 × 1.8 × 850	= 1220	1.32
Q " 400yr	= 1 × 0.8 × 3.8 × 850	= 2580	2.8
" 2000 AD "	= 1 × 1.0 × 3.8 × 850	= 3240	3.5

Compare 3240 with 1955 Floods. 1.5 sq.mi on $Q = 5000\sqrt{A}$ = 4150 cfs.
= 6000 on 1445

SUCCESS 1460 Ac — 2.28 sq. mi

Entire area developing rapidly except 132 Ac owned by Rem Arms.

Rolling terrain rather flat

Chart B Q = 1150 cfs (Constant .685)

			cfs/Ac
Q pres. 25yr	= RF × LF × FF × Q		
	= 1 × 0.6 × 1 × 1150	= 690 cfs	0.47
" 100	= 1 × 0.6 × 1.8 × 1150	1250	0.85
" 400	= 1 × 0.6 × 3.8 × 1150	2620	1.8
2000 AD "	= 1 × 1.0 × 3.8 × 1150	4370	3.0

Provided Rem Arms Controls large area

Stillwater 2200 Ac 3.44 sq. mi. Chart B Q = 1500 (Constant .455)

			cfs/Ac
Q pres 25yr	= RF × LF × FF × Q		
	= 1 × 0.7 × 1 × 1500	= 1050	0.48
" 100	= 1 × 0.7 × 1.8 × 1500	1890	0.86
" 400	= 1 × 0.7 × 3.8 × 1500	4000	1.8
2000 AD "	= 1 × 0.9 × 3.8 × 1500	5130	2.3

Provided Rem Arms & G.F. do not develope 330 Ac.

(A) I.W.G.

Forest [illegible]

J.W.C.
5/4/66
5/8/66

Lake Forest #45

5.80
2|11.55
5.775

Watershed
Cell. 4|5.78 sq.mi
1.443 Sq.mi
925 Ac

Lake Area
0.48
2|.24
4|.12
.105 sq.mi
67 Ac

Len. shed 2.25± mi
Aver width " .65± "

Storage Ratio 1 : 14 Fair

Lake Success above Stillman

Watershed
9.13
2|18.24
4|9.12
2.28 sq.mi
1460 Ac

Lake Area
0.18
3|0.46
4|.153
.038 Sq.mi
24 Ac

Storage Ratio 1 : 61 Very Poor

Owned by Rem Arms trib to Success.
4|.82
.205 sq.mi 132 Ac

Stillman Pond below Success

Watershed
4.70
2|9.36
4|4.68
1.171 sq.mi
750 Ac

Lake Area
.0.06
2|6.11
4|.055
.014 sq.mi
9 Ac

Owned by Rem Arms & G.E. trib to Stillman including trib To Success
4|2.06
.515 330 Ac.

Storage Ratio 1 : 83 Very Bad practically 0

TOTAL Stillman #46 (including Success)

Watershed
13.76
2|27.55
4|13.77
3.44 sq.mi
2200 Ac
1460
750
2210 Check

Lake Surface
Success 24 Ac
Stillman 9
Total 33 Ac

Len. shed 3.15± mi
Aver width " 1.1± "

Total Storage Ratio 1 : 67 Very poor (B)

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(R)

Dam E 45
Lake Forest

1

Aug 1908 Map indicates
Top dam. 175.40
Spillway 170.85
" notch. 4.55
" length 37' by scale

In field May 7 1966 spillway notch is 35.5' x 3.25'

Apparently after 1908 spillway was raised about 1.3'. Also some excavating and filling was done. The original stone wall shown on both the 1897 & the 1908 plans is not to be seen; it was buried or removed. The channel from the twin gate houses to "Canal to Channel Pond", as shown on 1908 map, has been filled in.

(C)

B-37

Dam #45
Lake Forest
Rational Method

Length 12,000± ft
Time Concentration 40 min @ 5' per sec
Precipitation 4" per hour ⇒ 100 yr precipitation
Intensity ⇒ 5" " " for 40 min = i
C by 2000 AD will be .45
A = 925 Ac
Q = A C i

Q_{100} = 925 x .45 x 5 = 2250 cfs
Q_{400} = 2250 x 2.1 = 4750 "

Summation

PL-4	Comparison with recent Earth Dams	4000 cfs	
A+P-7	By Public Roads formula (2000 AD / 400 yr)	3240 "	400 yr / 2000 AD
E	" Cook method (")	4550 "	"
D	" Rational " above "	4750 "	
PL-6	" $Q_{1955} = 3000 \sqrt{1.445}$	3600	

5 | 20,140
4,000 ±

(C) By, Cir #4 Bureau Public Roads
1961 Q_{400} = 5960 cfs or 2700 cfs/sqm
5/24/66

W.W.C
5/14/66

(D)

B-38

Dam #45
Lake Forest
Design Q by Cook method

Watershed length = 2.25 mi = L.

" area = 1.445 sq mi.

$W = \frac{2.25^2}{1.445} = \frac{5.0625}{1.445} = 3.5$

By Fig 3 Enter. $\frac{L}{W} = 3.5$

and Area = 1.5 sq. mi

Shape factor = .7

ΣW	Relief	20
	Soil	15
	Surface Veg Cover	10
	Surface storage	15
	ΣW =	60

Enter Fig 2 with $\Sigma W = 60$ and Area = 1.5 sq. mi

Peak Q = 1800 cfs

By Fig #1 25 yr peak is .95 for Cook.

25 yr Peak 1800 x .95 x .7 = 1200 cfs

100 " " 1200 x 1.8 = 2160 cfs

400 " " 1200 x 3.8 = 4550 cfs

E

S.W.C
5/14/66

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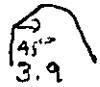
Mechanic St Lake Forest

	#35-3 (1) Chamberlain	#22 (2) Upper Stillwater	# 34 (3) Norwalk	(4) Mill River
Watershed	4.1 sq.mi	10.48	2.32 sq. mi	4.25 sq. mi
Spillway Len	50'	100'	200'	100'
" H	12'	12'	5'	10'
Safe ht	9' 3½ 27	9' - 27	3.5 - 6.55	5 design 8 safe
Weir type				
C e.g.	e.g. =4 4 x 50 x 27	Ce9 = 4 4x100x27	3.3 3.3 x 200 x 6.55	Ce5' 3.9 Ce8' 4.0
Q	5400 cfs	10,800 cfs	4300	Qe5' 4050 cfs. Qe8' 9000 "
Q/sq.mi	1320 cfs	1030 300 e Road	1860	Q/sq mi 5' 1030 8' 2120
Res. Area	102 Ac	290	87	+5 115 Ac FL 105 "
Shed "	2620 "	6700	1480 Ac	Shed 2710 " Stor. 110 Ac
Ratio	1:26 good	1:22 good	1:16 very good	Ratio 1:27 good
Type Shed	Semi rural rugged	Very Rural Steep Side	Semi Rural Rolling	Semi Rural
Area Spillway	600 sq.ft	1200	1000	orig 500 1000
Area/sq.mi	145	115	430	118 236

NOTES: #4 Originally intended spillway 50' x 10' but to avoid flooding a highway during bad storms decided 100' x 10'. If original 50' x 8' Dim H. then Q = 4 x 50 x 22.6 = 4520 cfs. but this would have flooded highway. C L 14½

F

J.W.C

Lake Forest
Dam #45

Peak by Circ #4 Comput Mtg

1b Drainage Area = 925 Ac (4.6) or .925 x 1000 Ac

1c Length of Streams (1) L = 2.31 miles, 4.62'

.3 L = .69 "

3.2 5 4 .7 L = 1.61 "

Elev (2) headwater 370 ft

4.62 / 7 / 3.2 5 4 b .7 above site 295 "

c at site 170±

$S_1 = \frac{370 - 295}{.3L} = \frac{75}{.369} = 109$ ft/mi $S_2 = \frac{295 - 170}{.7L} = \frac{125}{1.61} = 78$ ft/mi

$\sqrt{S_1} = 10.4$ $\sqrt{S_2} = 8.8$

$T = \frac{.3L}{\sqrt{S_1}} + \frac{.7L}{\sqrt{S_2}} = \frac{.69}{10.4} + \frac{1.61}{8.8} = .066 + 1.83 = .260 = T$

2. Fig 1

a P-Index = 2 Zone? Not #1

3. Q10 using Fig 2 Zone "1?"

Area .925

Index 2

T .26

a 1st Ex Q_{10} = .36 in 1000 cfs = 360 cfs

b. Using Zone #1? Fig 3 $\hat{T}$ = .18

Fig 3 Area .925

P-Index 2

T .26

$\frac{\hat{T} - T}{\hat{T}} 100 = \frac{.8}{.18} = 44\%$

$\frac{\hat{T} - T}{\hat{T}}$ is greater than ± 30% 90 to 34

(G) Circ #4 1 of 2

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Lake Forest Circ #4 cont'd

3d. Adjusting Q_{10}

(1) $\frac{T}{A} = \frac{.25}{.18} = 1.44$ Fig 4 $C = 1.75$

(2) $C \times Q_{10}$ of 3a $= 1.75 \times 360 = 630$ cfs

Fig 5

Enter $Q_{10} = 630$

Read $Q_{25} = 850$

$Q_{50} = 950$

$Q_{100} = 1300$

By State Formula					
1.85	10		630 cfs		700 ± cfs
2.75	25	1.47	925		1000
3.7	50	2	1250		1375
5	100	2.7	1700		1900
7.2	200	3.9	2450		2700
10.6	400	5.7	3600		4000 ±

But Circ #4 is for Zone #4 is for a very restricted area insofar as Conn is concerned. It therefore is not unreasonable to assume that lower Fairfield county might not be in a Zone more productive of run off therefor add approx 10% to above to obtain approx 5960 cfs.

Circ #4 2012

J.W.C.

(G)

Vam -45

Plot Bridgeport

Precipitation

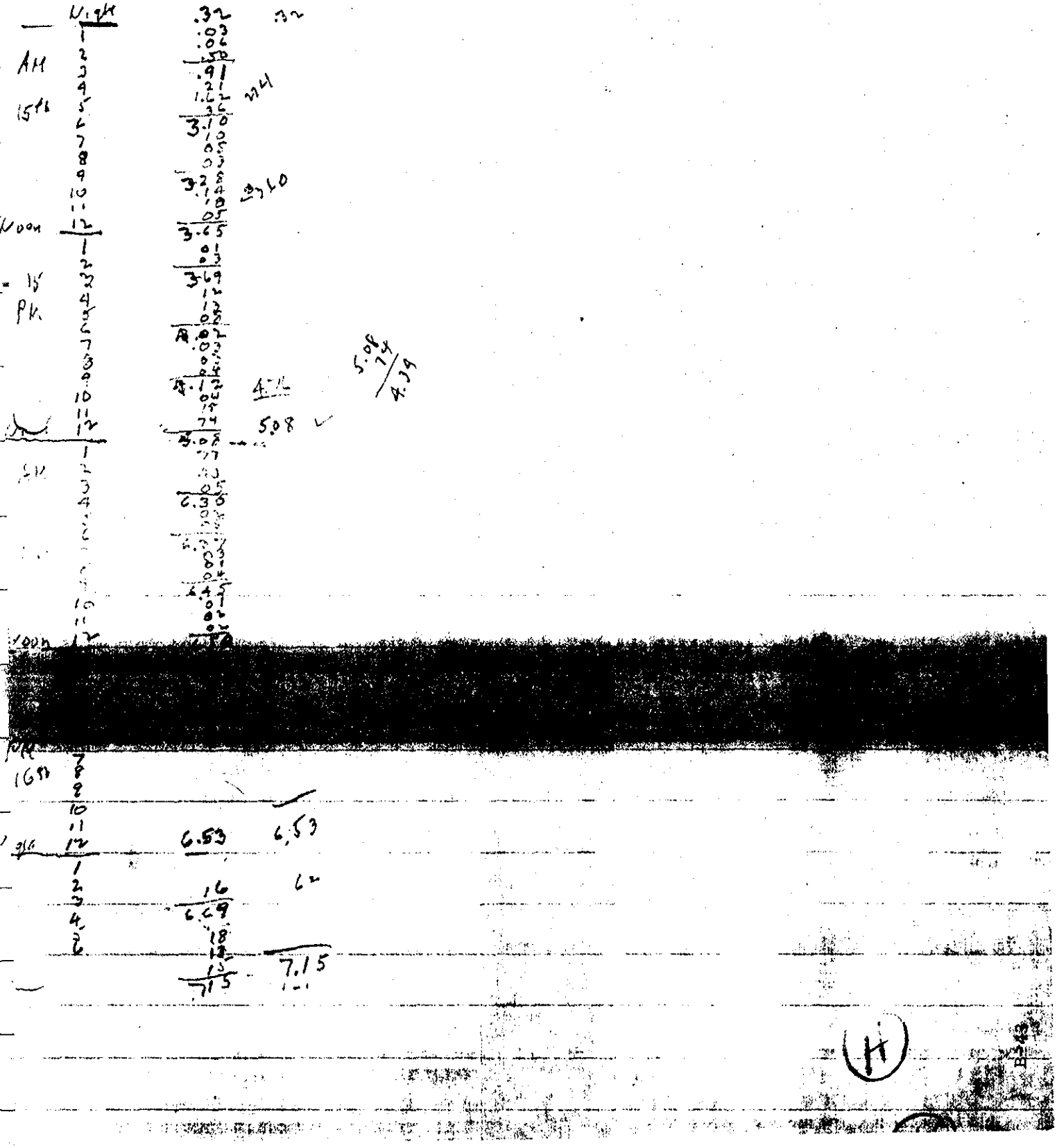
Oct 1955

acc Lake Forest

Oct

PM. 14

Noon .02



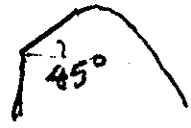
Stamford Water Co.
Mill River Reservoir
by Mr. Bell 5/13/66 Tel. 324-3163

Watershed Conn 1.97
N.Y. 2.29
→ Total. 4.25 • 2720 Ac.

3.42
6.5
4.07 ← Reservoir @ F.L. 105 Ac.
4.25
8.32 " @ design Fl. 115 "
26.56

Area for storage factor 110 Ac
Flood " " 1: 27 => 900 cfs

By Ralph Harstead 5/13/66



Spilling L = 100'
" d = 10'

Section 45° Ogee. same as Chamberlain & Upper Shepaug.

Both { Said 100'x10' to prevent flooding of a highway etc.
Bell

Ralph said Design Flood H = 4'-9" (4.75') Q = 4000 cfs.

B-44

(I)

JOHN J. MOZZOCHI AND ASSOCIATES
CIVIL ENGINEERS

GLASTONBURY, CONN. 06033
217 HEBRON AVENUE
PHONE 633-9401

PROVIDENCE, R. I. 02903
200 DYER STREET
PHONE GASPEE 1-0420

ASSOCIATES
OWEN J. WHITE
JOHN LUCHS, JR.
ECTOR L. GIOVANNINI

REPLY TO: Glastonbury

February 10, 1969

STATE WATER RESOURCES COMMISSION
RECEIVED
FEB 12 1969
ANSWERED
REFERRED
FILED

William H. O'Brien, III
Civil Engineer
Water Resources Commission
State Office Building
Hartford, Connecticut 06115

Re: Lake Forest Dam
Bridgeport, Connecticut
Our File No. 57-73-86

Dear Mr. O'Brien:

As requested in your letter of December 26, 1968, I inspected the referenced dam on January 11, 1969. The lake is southeasterly of the Ox Hill section on the northerly edge of Bridgeport in a single family residential section. The lake frontage is developed with lake front lots excepting a portion along the dam. Considerable foot traffic is evident on top of the dam and in certain locations on the downstream slope (paths).

The existing conditions at the site are not in agreement with the 1960 U.S.G.S. map, indicating some recent changes. There is an angle point in the dam and the U.S.G.S. map shows the outlet to be easterly of this angle point. The present discharge from the lake is through a spillway and cobble channel west of the angle point.

There is an inlet structure (house) in the lake; a control house (?) downstream of the dam and a 30" concrete discharge pipe outletting in the brook. These are in the general location of the outlet as shown on the U.S.G.S. map. There was no discharge in the 30" pipe. This leads me to believe these appurtenances were part of the principal spillway and the outlet presently being used was the emergency spillway. I was not able to enter either of these two (2) houses for additional inspecting.

The concrete spillway is 36' (feet) in width and a clear height to the bottom of the steelof a foot bridge over thespillway of 38". The bottom of the steel is approximately the same elevation as the top of the dam. The upstream slope of the

B-50

dam is cobbled (set stone).

The spillway adequacy was checked as follows:

	FREQUENCY (YEARS)	DURATION (HOURS)	RAINFALL (INCHES)	WATER LEVEL ABOVE SPILLWAY CREST (FEET)	DISCHARGE THROUGH SPILLWAY (C.F.S.)
1.	10	6	3.5	1.9	310
2.	25	6	4.0	2.3	405
3.	50	6	4.3	2.6	480
4.	100	6	5.1 x 1.3 = 6.9 (Roughly equivalent to Diane)	3.9 - say 3' 11"	690

With approximately 3' 2" from spillway crest to top of dam, it is evident the dam could be over-topped. It is impractical to increase the height of the dam due to the development of the lake; therefore additional spillway should be provided. The area westerly of the present spillway can be utilized for this purpose.

Listed below are my recommendations resulting from the field inspection and the calculations:

1. Provide additional spillway capacity west of the existing spillway on original ground.

2. Remove brush and small trees on embankment.

3. Regrade embankment to provide a minimum top width of ten (10) feet and a 3:1 downstream slope. Slope to be loamed and seeded.

4. Remove debris from cobblestone channel and repair sidewalls that have collapsed (short sections).

Very truly yours,

JOHN J. MOZZOCHI & ASSOCIATES

By John Luchs
John Luchs, Jr. Associate

JL/ed
file

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MOZZOCHI ASSOCIATES
CIVIL ENGINEERS

GLASTONBURY, CONN. 06033
217 HEBRON AVENUE
PHONE 633-9401

PROVIDENCE, R. I. 02903
169 WEYBOSSET STREET
PHONE 421-0420

PARTNERS
JOHN LUCHS, JR.
STUART J. BECKERMAN

REPLY TO: Glastonbury

December 14, 1970

William H. O'Brien, III
Civil Engineers
Water Resources Commission
State Office Building
Hartford, Connecticut 06115

Re: Lake Forest Dam
Bridgeport
Our File #57-73-86

Dear Mr. O'Brien:

We are in receipt of a copy of Charles Augur's letter dated November 4, 1970 and a print of some sections dated July, 1970. These were forwarded to us by Mr. Pelletier when you were in the hospital.

Mr. Augur has brought up a point needing clarification. The SCS map for Class "C" structures shows 10.3"/6 hr. precipitation. My letter of October 12, 1970 states Class "C" should be 15.5"/6 hr. precipitation. The 15.5" comes from a standard we have been following for SCS flood retention (10.3" x 1.5 = 15.5" ±) dams. The 1.5 multiplier is unknown to Mr. Augur and I can well understand his questioning when he has no other information supplied to him. This multiplier does provide for a high degree of safety.

Reviewing the CGS quad sheet does show that Island Brook (from Lake Forest) does pass through a residential section of Bridgeport with three (3) other structures (dams) along its route before discharging into the Poquonock River. This type of basin, in my opinion, dictates that extreme care be used in developing criteria for Lake Forest.

With the additional information of a concrete core wall being located, it is reasonable to compromise some of my original recommendations listed in my letter dated February 10, 1969. From our flood routing analysis (135.'of spillway), the following has been developed:

	STORM	MAX. W.S.		Required TOP OF DAM	Required RAISING
A.	10.3"/6 hr	98.6'±	1650 cfs.	100.6'±	0.6'±
B.	15.5"/6 hr	99.'5±	2500 cfs.	101.5'±	1.5'±

Adding an additional 1.5'± to the top only of the remaining embankment

D.A. = 1.445 mi²

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(that portion across the valley) does not appear as an excessive requirement considering the downstream basin. This will produce a top width of 8'± if the present slopes are maintained. Where the embankment meets original ground at either end, the filling can be terminated.

In summary, it is recommended that the following criteria be used for this dam.

1. Use a 15.5" rainfall/6 hr precipitation.
2. Add 100' of spillway to the East of existing spillway.
3. Top width of embankment to be 8'±.
4. Slopes to remain "as existing".
5. Remove brush and small trees from embankment.
6. Raise remaining embankment of dam (filled portion) 1.5'±.
7. Loam and seed top of embankment.

If you have any questions, please call.

Very truly yours,

MOZZOCHI ASSOCIATES

By John Luchs, Jr., P. E.

JLjr:ed
file

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ISLAND BROOK DRAINAGE STUDY

LAKE FOREST SPILLWAY TO POQUONOCK RIVER

CITY OF BRIDGEPORT, CONN.

SEELYE STEVENSON VALUE & KNECHT, INC.
Consulting Engineers
2385 MAIN STREET STRATFORD, CONN.

DECEMBER, 1973

REPORT OF

ISLAND BROOK

DRAINAGE STUDY

FROM

LAKE FOREST SPILLWAY

TO

POQUONOCK RIVER

BY

SEELYE STEVENSON VALUE & KNECHT, INC.
2385 Main Street
Stratford, Connecticut

DECEMBER, 1973

SEELYE STEVENSON VALUE & KNECHT, INC.
CONSULTING ENGINEERS
Founded 1812
CIVIL • HIGHWAYS • STRUCTURAL • MECHANICAL • ELECTRICAL • INDUSTRIAL
99 PARK AVENUE
NEW YORK, N. Y. 10016
271 NORTH AVENUE
NEW ROCHELLE, N. Y. 10801
CONNECTICUT OFFICE
TUTTLE BUILDING
2385 MAIN STREET
STRATFORD, CONN. 06497

December 17, 1973

Mayor Nicholas A.Panuzio
City Hall
Lyon Terrace
Bridgeport, Connecticut

Re: ISLAND BROOK DRAINAGE STUDY

Dear Mayor Panuzio:

Pursuant to your authorization, we have performed a Drainage Study for Island Brook from the Spillway at Lake Forest to the Poquonock River.

Our analysis indicates hydraulic deficiencies in the spillways at Lake Forest and Charcoal Pond and at all the roadway culverts along the Brook with the exception of the Culvert under the Route 25 Expressway and North Avenue. It also indicates that walls, fills and other obstructions, limit the stream flow which could be accommodated by the channels without flooding.

Our study includes recommendations for culvert and channel improvements, alternate proposals for improvements, stream encroachment lines, construction priorities, and construction cost estimates. Also included is a proposed ordinance for flood plain zoning and a determination of availability of Federal or State Funding for the proposed improvements.

We wish to express our appreciation for the assistance extended to us during the course of our work by Mr. Robert Kalm, City Engineer, and members of his staff.

Respectfully submitted,

SEELYE STEVENSON VALUE & KNECHT, INC.

By: S E Kraffmiller
S. E. Kraffmiller, P.E.
Ass't. Vice President

R W Gunn
R. W. Gunn, P.E.
Sr. Vice President

SEK:rm

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TABLE OF CONTENTS

ISLAND BROOK DRAINAGE STUDY

PURPOSE

The purpose of this report is to:

1) Analyze the existing drainage structures and stream channels along Island Brook from Lake Forest to the Poquonock River.
2) Analyze the existing spillways at Lake Forest and Charcoal Pond
3) Make recommendations for improvement or replacement of existing culverts of channels so that the design flood may be conveyed without property damage or inconvenience to the residents of the area.
4) Study alternate proposals so that the most economical and feasible solution is recommended.
5) Set stream encroachment lines so that existing adequate waterway areas and proposed channel improvements may be protected from construction that would cause constrictions and possible flooding.
6) Submit a proposed flood plain zoning regulation to establish stream encroachment lines
7) Present construction cost estimates for the recommended improvements and alternates considered
8) Present an order of construction priorities for the proposed improvements
9) Present our findings on the availability of Federal or State Funding for the proposed improvements

METHOD

40 Scale mapping was obtained by ground control survey and aerial photography flown April 21, 1973. The aerial data was supplemented by field survey measurements and sewer and street maps supplied by the City Engineer's office. Land use was determined by site inspection, zoning maps and projections of current trends. Rainfall

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data was obtained from records of the U.S. Weather Bureau at Bridgeport Airport, Rainfall Intensity Curves from the State of Connecticut, Department of Transportation, Bureau of Highways Drainage Manual and the U.S. Soil Conservation Publication - Hydrology Part I - Watershed Planning.

GENERAL BACKGROUND

Under this section of the Report, the factors contributing to development of assigned values in various flood flow formulas used will be discussed.

These factors are:

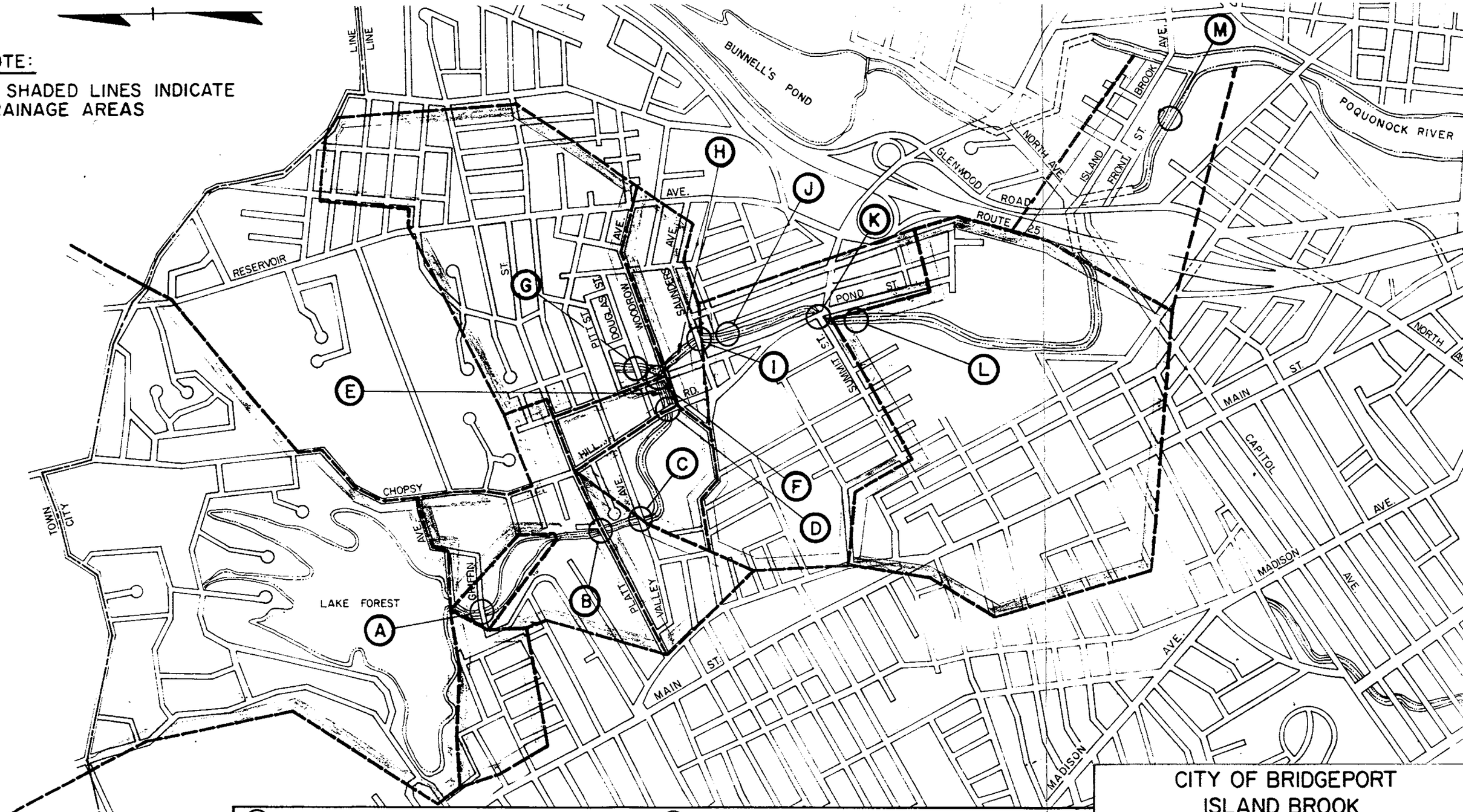
1) The degree of imperviousness of the watershed area as determined by the current land use, zoning laws, projected land use and soil characteristics.
2) Slope and shape of the watershed
3) The area of the watershed
4) Retention features within the watershed

Island Brook originates in the Long Hill area of the Town of Trumbull, as the outlet of Ehrsham Pond. It flows in a southeasterly direction into Lake Forest, which was a Bridgeport Hydraulic Reservoir and is now owned by the Lake Forest Association. From Lake Forest, it again flows southeasterly through Charcoal Pond to the Poguonock River, which it enters approximately 500' south of the Island Brook Avenue Bridge over the Poquonock River.

The watershed area above LakeForest is approximately 940 acres and the total watershed area is approximately 1,900 acres. The surface area of Lake Forest is approximately 76 acres. Since the area of Lake Forest is about 8% of the watershed area which contributes to the Lake, significant reduction of flood runoff is obtained by retention under all storm conditions.

NOTE:

SHADED LINES INDICATE DRAINAGE AREAS



(A) GRIFFIN AVE.- HEADWALL
(B) PLATT ST. - WINGWALL
(C) VALLEY AVE. - CULVERT & CHANNEL
(D) CHOPSY HILL RD. - CULVERT & CHANNEL
(E) CHOPSY HILL RD. TO POND ST. - CHANNEL
(F) POND ST. - CULVERT
(G) PITT ST. TO WOODROW AVE. - CULVERT
(H) WOODROW AVE. TO SAUNDERS AVE. - CHANNEL
(I) SAUNDERS AVE. - CULVERT
(J) SOUTH OF SAUNDERS AVE. - CHANNEL
(K) SUMMIT ST. - CULVERT
(L) SOUTH OF SUMMIT ST. - CHANNEL
(M) NORTH AVE. TO POQUONOCK RIVER - CHANNEL

CITY OF BRIDGEPORT
ISLAND BROOK

DRAINAGE STUDY LOCATION MAP

PAGE 3

SEELYE STEVENSON VALUE & KNECHT
CONSULTING ENGINEERS
STRATFORD CONN.

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'ND USE AND ZONING

The land use currently in the watershed area above Lake Forest is mostly medium density residential. Some small commercial development is also located within the area and there are some small parcels of undeveloped land.

Zoning maps indicate that the watershed area is zoned entirely A - Residential - single family housing on a minimum 1/2 acre lot, within the Town of Trumbull

The zoning within the City of Bridgeport in the watershed area above Lake Forest is also Residential A Zoned with some municipal park land. Residence A Zone in the City allows single family housing on 7,500 sq. ft. lots.

Between Lake Forest and North Avenue, the current land use within the watershed area is mostly medium density housing, some cemetery lands, some small undeveloped parcels and some high density residential apartments. The current land use conforms to the zoning for this area.

Land use in the watershed area below North Avenue is mostly light industrial and commercial with some high density housing. Zoning in this area is almost entirely light industrial with some commercial and a parcel of heavy industrial.

PROJECTED LAND USE

It is the object of the Report to recommend drainage facilities that will be adequate to accommodate flood runoff from the watershed as it is developed at the year 2000. The area above Lake Forest still contains some undeveloped land and some inland wet lands. This area is zoned as A residential in both Bridgeport and Trumbull as previously noted. It is doubtful that this zoning will continue, due to the pressures of housing needs and rising land values. The more likely development will be condominiums and garden apartments. The desire to protect the environment will have a minimal influence on development in this portion of the watershed area.

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It is projected that higher density housing will probably occur in this area. Inland wet lands, which were a significant factor limiting runoff for this area 20 years ago have been, in the most part, filled and developed. Ehrsham Pond has been greatly reduced in area by filling for park and home site development. Legislation for the protection of wet lands has come too late for this watershed and the remaining small wet lands, if retained, have little value for retention.

It is,therefore, projected that runoff from this area will be increased.

Some areas of undeveloped land remain between Lake Forest and North Avenue. It is anticipated that future development of these lands will be residential apartments. It is also anticipated that some existing housing in this area will be replaced by residential apartments. Streets which are now mapped, but not constructed, will be completed with curbs and storm drains. These factors indicate that future runoff will be substantially increased in this area.

Below North Avenue, the current land use is such that the degree of imperviousness is very high. The street system and drainage is complete and there is little undeveloped land. These factors indicate that any future development will not increase the current runoff.

SOIL CHARACTERISTICS

The soils of this drainage basin, as classified by the Soil Conservation Service, are predominantly well and moderately well drained, permeable soils of the Charlton-Gloucester-Sutton Association. These are upland soils moderately permeable to depths of three to four feet. They have developed on very friable to firm glacial till.

The soil is rated as being in the hydraulic Group B by the Soil Conservation Service. The grouping of soils by the Soil Conservation Service, however, assumes that the land will be used for agricultural purposes. The suburban type development of this area would indicate a greater imperviousness resulting in a hydraulic classification of the drainage basin into Group C.

The preliminary soil classification also indicates the presence of peat bogs and muck areas along the alignment of the Brook, along with some areas of rock outcrop. These are not extensive enough, however, to indicate any unusual construction problems.

SCOPE AND SHAPE OF THE WATERSHED

The shape of the watershed is generally long along the north to south direction of flow and narrow from east to west. The slopes north of Woodrow Avenue are steep, between Woodrow Avenue and Summit Street moderate, and below Summit Street they are gentle to flat. The shape and the slopes of the watershed indicate rapid runoff should be anticipated, particularly north of Woodrow Avenue and becoming slower downstream.

DESIGN CRITERIA

The analysis of the outflow from Lake Forest has been based on the method of flood routing described in Hydrology Part I - Watershed Planning, by the U.S. Soil Conservation Service. The routing process is further based on the Unit Hydrograph Theory.

Soil conditions in the watershed indicated the selection of soil Hydraulic Group C. Antecedent Condition II was selected, which is the average case for annual floods. Based on current and projected land uses, Curve No. 72 was used.

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Below Lake Forest, runoffs were determined by the Rational Method. The rmula is as follows:

$$Q = A\ C\ i$$

Where Q = the Peak Rate of storm water runoff in cubic feet per second (cfs)

A = Drainage area in acres
C = A constant relating rainfall to runoff
i = Rainfall intensity in inches per hour

The rainfall intensity varies with the return frequency of the design storm and the storm duration.

DESIGN STORM

Selection of the return frequency of the design storm is based on a judgment of cost of the improvements versus the possible inconvenience to residents, property damage, or loss of life. Many Cities and Towns follow the procedure of using a 5 year return frequency in rural areas, 10 years in surburban areas and 25 years in urban areas.

The State Highway Department designs all crossings of flowing water courses for a minimum 50 year return frequency storm. It is our recommendation, due to the possibility of severe inconvenience to local residents and the possibility of property damage that all culverts and channels along Island Brook be designed to adequately convey the runoff anticipated from a design storm of a return frequency of 25 years.

STORM DURATION

Rainfall intensity curves used with the Rational Formula indicate that long duration storms have less average intensity of rainfall than short duration storms.

Our calculations show that long duration lower intensity storms have the most critical impact on the spillway at Lake Forest and the culverts and channels immediately downstream and short duration high intensity storms have the most itical impact on the remaining culverts and channels. All culverts and channels

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have been analyzed for both short and long duration storms. The critical storm rations have been found to range from 20 minutes at the Douglas Street culvert to 6 hours at Lake Forest spillway.

FLOOD OF RECORD

The greatest 24 hour rainfall recorded in the history of the U.S. Weather Bureau Station at Bridgeport Airport was June 22, 1972 during Hurricane Agnes, which was recorded as 6.89". During this storm, the maximum 6 hour rainfall was 5.9" which is approximately equal to a 100 year return frequency storm. Climatogical data, published by the National Climatic Center shows 24 hour rainfalls during Hurrican Agnes included 11.88" at Dulles Airport in Virginia, 13.6" in the Blue Ridge Mountains of Central Virginia, 11.55" in Westminister, Maryland and 13" in Steuben County, Pennsylvania.

HYDRAULIC ANALYSIS

LAKE FOREST

Due to the retention effect of Lake Forest, runoffs to the downstream structures are reduced by 50% to 75%. Plate No. 1 shows the reduction of flows during the period of record, June 22, 1972. Without retention, the outflow would be equal to the inflow. Plate 1 shows a maximum inflow of 1,240 cfs and maximum outflow of 440 cfs or a reduction of 65%.

The spillway at Lake Forest has been analyzed by other Engineers at the direction of the Water Resources Commission in the past.

During the preparation of the Report, previous engineering studies have been reviewed and an independent analysis of the spillway has been made. The design storm selected in previous studies is 15.5" of rain in a 6 hour period. In accordance with Soil Conservation Service Criteria, the dam classification is Class C. The classification is based on degree of potential hazard.

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Class C dams are those dams which, if failure should occur, would cause large amounts of property damage and have a potential of causing loss of life. The Soil Conservation Service Criteria for a Class C dam is 10.3" in 6 hours for an emergency spillway and 25" in 6 hours for principal spillways. In accordance with the Soil Conservation Service Criteria, a minimum 6 hour precipitation of 25" should be used as the basis for developing the spillway design. A 6 hour precipitation of 25" is the probable maximum precipitation for coastal Connecticut and is a very conservative basis for design. The Water Resources Commission of the State Environmental Protection Agency has indicated that a 6 hour precipitation of 15.5" is acceptable for design. It is our opinion that this is a reasonable compromise.

Our analysis indicates that the storm of June 22, 1972, 5.9" rainfall in 6 hours, raised the level of the lake to Elev. 176.82 or approximately 11" below the top of dam. It also indicates that in order to accommodate a 15.5" rainfall in 6 hours with 18" of free-board, the spillway should be lengthened approximately 100' and the top of dam raised approximately 18".

The downstream structures have been analyzed for a 25 year return frequency storm. Plate II indicates the increased outflow from Lake Forest for various spillway lengths, including the 35' width existing spillway and 135' width spillway which has been proposed.

The proposed channel and culvert improvements described below are shown on plans sheets Nos. 1 to 11, which are on file at the Office of the City Engineer. These plans show existing topography and contours obtained by survey with the proposed improvements superimposed on this mapping. In addition, the boundaries of the area which will be innundated by the design flood are shown by a heavy dashed line. These boundaries are based on completion of the culvert and channel improvements recommended in this report. Proposed stream encroachment lines which conform to these flood limits are also shown. These encroachment lines may be legally established by ordinance.

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The mathmatical description of these stream encroachment lines is listed on tables on each sheet.

CHANNEL BETWEEN LAKE FOREST SPILLWAY AND GRIFFIN AVENUE

The channel between Lake Forest spillway and Griffin Avenue has a slope of 0.014 ft./ft., and the width varies from 20' to 25'. It is lined with stone masonry walls approximately 2' high. The channel is adequate for the design storm with the proposed 135' spillway at Lake Forest and will flow approximately 1.3' deep. Channel improvement is not required, but some energy dissipating structure should be included in the design of the Lake Forest spillway to limit erosion of the channel.

CULVERT AT GRIFFIN AVENUE

The existing culvert at Griffin Avenue has a 10 foot width and has a height of 4 feet. It has stone masonry walls and concrete deck slab. The apparent condition of the culvert is good. The control elevation for flooding is the basement floor elevation of House #53 Griffin Avenue, Elevation 151.3. The elevation of the centerline of Griffin Avenue at the low point over the culvert is 154.7. Maximum flow at this culvert occurs during a 6 hour storm. With the existing spillway, the maximum runoff during the 25 year return frequency design storm is 163 cubic feet per second, causing a backwater elevation of 151.2.

If the Lake Forest spillway is lengthened to 135', the runoff would be increased to 340 cfs, and the backwater elevation increased to 152.5 with an improved headwall. In order to protect House #53 against damage, the channel wall adjacent to the house could be replaced with a higher wall, top elevation 153.0, extending upstream until the natural bank reaches elevation 153.0. The home owner has a catch basin in his driveway. A flap gate should be installed on the catch basin outlet pipe to prevent the flow from backing up the outlet and into the basement.

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In order to construct the wall adjacent to the channel, a row of trees would have to be removed. It would appear that removal of many attractive trees would be more detrimental to the property owner than the extremely rare basement flooding that may occur. The 10 year return frequency storm with a 135' spillway at Lake Forest would not cause flooding of the basement, provided the flap gate is installed.

CHARCOAL POND

The area of Charcoal Pond is approximately 3 acres. Since surface area is less than 1/2% of the watershed area contributing to the Pond, the retention effect is negligible. Our calculations indicate that the inflow is equal to the outflow under all storms studied. The calculations also indicate that if the spillway at Lake Forest is lengthened to 135', the spillway at Charcoal Pond must also be increased. In order to convey a precipitation of 15.5" in 6 hours, without over-topping the earth berm and allowing 12" of free-board, the spillway should be lengthened 80' and the berm raised approximately 15".

CHANNEL BETWEEN CHARCOAL POND AND PLATT STREET

The slope of the channel varies from .06 ft./ft. to.02 ft./ft. and varies in width from 8' to 14'. The channel is lined with stone masonry walls upstream from the Platt Street culvert for 100' and the remaining channel has natural banks. The channel is adequate for the design storm with a 135' spillway at Lake Forest and no channel work is required in this area.

CULVERT AT PLATT STREET

The existing culvert at Platt Street is a concrete box culvert with an opening 8 feet wide x 4-1/2 feet high. The low point on Platt Street near the culvert is at elevation 131.3. Adjacent to the stream at the upstream end of the culvert, the garage at House #738 Platt Street has a floor elevation of 129.7'.

The maximum backwater elevation during the design storm with the Lake Forest spillway improved is 130.4'. In order to prevent flooding of the garage, the wall lining the brook at this site should be raised to elevation 131.5 and lengthened.

CHANNEL BETWEEN PLATT STREET AND VALLEY AVENUE

The existing channel is steep, slope varying between 0.05 ft./ft. and 0.03 ft./ft. with high banks and the width varies between 8' and 20'. The channel is adequate and the only improvement required is to accommodate the new culvert required at Valley Avenue.

VALLEY AVENUE CULVERT

The existing culvert at Valley Avenue has a concrete deck on stone masonry walls. The culvert opening is 10 feet wide x 3 feet high. The control elevation on Valley Avenue is 104.3' and all adjacent structures are at a higher elevation. During the design storm with a 135' spillway at Lake Forest, the culvert is inadequate and the flood would overtop Valley Avenue. It is recommended that the culvert be replaced with a structure having a width of 10' and a height of 4' at a lower elevation than the existing culvert. Approximately 50' of channel improvement is required upstream and 250' downstream.

CHANNEL BETWEEN VALLEY AVENUE AND CHOPSY HILL ROAD

The existing stream in this section has a great variation of slopes and widths. The natural channel is adequate since there are only some minor constrictions and the adjoining houses have been built back from the stream at fairly high elevations. The improvements required are at the existing Valley Avenue culvert and the entrance of the Chopsy Hill Road culvert.

CULVERT AT CHOPSY HILL ROAD - NEAR WOODROW AVENUE

The existing culvert at Chopsy Hill Road is a concrete box culvert 8' wide and 3-1/2' high. The control elevation for flooding is 62.5' at the centerline of Chopsy Hill Road. The flow during the design storm at the culvert is 398 cfs, which

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cannot be conveyed without overtopping Chopsy Hill Road. It is recommended that the culvert be replaced with a structure 10 feet wide x 4' high set at lower elevation than the existing culvert.

CHANNEL BETWEEN CHOPSY HILL ROAD AND POND STREET

The flood plain of the existing stream in this section has been filled for the construction of Woodrow Avenue on the south and occupied by houses on the north. The stream cannot convey the design storm within the existing banks. An improved channel is required for the section, lowered approximately 2'. The proposed channel section has an 8' bottom width, 2:1 side slope on the north bank and 1:1 side slope on the south bank. Riprap is required on the south bank to stabilize the steep slope and protect the wall adjacent to Woodrow Avenue from erosion.

CULVERT AT POND STREET

The existing culvert at Pond Street consists of two 54" reinforced concrete pipes. The limit of flooding is set by the basement floor elevation of House #627 Pond Street at elevation 59.8'. The invert of the existing culvert is 55.1'. The capacity of the existing culverts holding the backwater elevation below 59.8' is approximately 200 cfs. The flow during the design storm at this point is 398 cfs and it is recommended that the culvert be replaced. Approximately 50' downstream from the Pond Street culvert, a major tributary draining approximately 165 acres to the northeast enters the stream. The main channel makes an abrupt right angle turn and enters the culvert under Woodrow Avenue. The existing condition causes additional flooding. In order to efficiently convey the flow, it is recommended that the Pond Street culvert be extended on a curved alignment across Woodrow Avenue. Since the recommended culvert would be approximately 135' long, it is further recommended that a special entrance be designed for the culvert which would reduce the size of the culvert to a 7' width with a 5' height of opening.

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CULVERT FROM PITT STREET TO WOODROW AVENUE

Drainage from approximately 160 acres outlets in an open channel south of Pitt Street from an existing 42" RCP. The flow again enters a 42" RCP which is joined to a 54" RCP outletting south of Douglas Street. Between Douglas Street and Woodrow Avenue there is another short section of open channel. The culvert under Woodrow Avenue has a width of 7.8' and a height of 4'. Severe flooding is experienced in this area during storms of less intensity than the design storm. In order to alleviate flooding in the area, it is recommended that a junction chamber be constructed in Pitt Street and a box culvert with a width of 7' and a height of 4' be constructed from the chamber to the south side of Woodrow Avenue. It is further recommended that a common headwall for the Pond Street culvert and the Pitt Street to Woodrow Avenue culvert be provided.

CHANNEL FROM WOODROW AVENUE TO SAUNDERS AVENUE

The flood plain of the existing stream has been constricted in this section by house construction and walls so that it cannot convey the design storm without overtopping the existing banks and causing property damage. It is recommended that a concrete channel be constructed 12' wide with 4' high walls from Woodrow Avenue to Saunders Avenue. The concrete channel is recommended to reduce the impact of land requirements on the adjacent property owners.

SAUNDERS AVENUE CULVERT

The existing culvert has a width of 7.7' and a height of 5'. It is constructed with stone masonry walls and a concrete slab. Control for flooding is the first floor elevation of House #484 Saunders Avenue at elevation 55.8'. During the design storm, the backwater elevation would rise to approximately 58.5', overtopping Saunders Avenue and flooding the house. It is recommended that the culvert be replaced with a box culvert having an opening 12 feet wide x 6 feet high at a lower elevation than the existing culvert.

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CHANNEL BETWEEN SAUNDERS AVENUE AND CHOPSY HILL ROAD AT SUMMIT STREET

The existing stream has been severely constricted in this section by walls, culverts and house construction. Various encroachments reduce the capacity of the channel to less than 25% conveyance required during the design storm. Several alternate solutions were studied to provide an adequate waterway area in this section. The alternates will be discussed later in the Report. The recommended solution, Alternate No. 1, is as follows:

1) Provide an earth channel downstream from Saunders Avenue approximately 450' in length. The channel bottom width required would be 12' and with one on two side slopes.

2) Construct a special entrance at the end of the channel and approximately 280' of box culvert with an opening of 9 feet wide x 6 feet high to a junction chamber.

3) The junction chamber would provide a diversion of low water flow to the existing stream channel. The chamber would be designed to limit the flow to the existing channel to its safe capacity of approximately 180 cfs.

4) The remaining flow would be conveyed in a box culvert in Pond Street and Chopsy Hill Road with the outlet below Summit Street adjacent to the existing culvert. The box culvert would have an opening 7 feet wide x 5 feet high.

CHANNEL BETWEEN SUMMIT STREET AND PRIVATE ROAD IN CEMETERY

The existing stream in this section is generally wide with a flat slope and only minor constrictions. Since the culvert invert at Summit Street has to be lowered approximately 2', a channel improvement is required for approximately 650', at which point the improvement will be transitioned into the existing natural stream. About 600' downstream from Saunders Avenue, the remains of an old abandoned dam restricts the channel. The channel improvement will include removing the obstruction. The recommended channel has a bottom width of 20', 1-1/2 to one side slopes. The velocity in the channel is such that riprap will be required on the slopes.

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CULVERT AT PRIVATE ROAD IN CEMETERY

The existing culvert at the cemetery entrance is a stone masonry arch with a width of 8' and a height of 5'. The waterway area is insufficient to convey the runoff during the design storm and the roadway will be overtopped to a depth of approximately one foot. The flooding caused by this constriction does not affect any properties beyond the cemetery and the only damage anticipated due to the flooding would be a washout of the cemetery entrance road. In order to convey the runoff during the design storm without overtopping the roadway, a twin 12' x 6' box culvert would be required. Since the existing culvert is privately owned and no damage or inconvenience will be suffered outside of the cemetery property, replacement of the culvert is not recommended. If any contruction is proposed within the flooding limits shown on the plans, improvement of the culvert should be made by the owner.

CHANNEL BETWEEN CEMETERY ROAD AND CAPITOL AVENUE

The existing channel has been improved during the construction of Route 25. It is a uniform section with a bottom width of 15' and a 1 on 2 side slope, and a slope of 0.013 ft./ft. The depth of flow during the design storm is approximately 6', which is contained within the banks. The channel is adequate.

CULVERT FROM CAPITOL AVENUE TO NORTH AVENUE

The existing culvert is a twin 12' x 6' concrete box culvert approximately 1,000' in length. It was constructed as part of the Route 25 Expressway project. It has been designed for maximum high tide and the runoff from a 50 year return frequency storm. The culvert is adequate.

CHANNEL BETWEEN NORTH AVENUE AND THE POQUONOCK RIVER

The stream in this section is subject to tidal influence. Perigee high tide at Bridgeport is elevation 6.0 above mean sea level. The combination of the perigee high tide and the design storm runoff causes overtopping the existing banks throughout most of the reach. Since the simultaneous occurrence of the extreme high tide and the design storm is a very remote possibility, we have based our recommendations

on average high tide which is at elevation 3.4 above mean sea level. Under this condition, the channel would still require improvement to convey the design flow without overtopping the banks. A channel improvement having a 25' bottom width and 1 on 1-1/2 side slopes is recommended for approximately 360 feet in length.

HYDRAULIC SUMMARY

ALTERNATE 1

LOCATION & DESCRIPTION	RECOMMENDED IMPROVEMENT	DESIGN FLOW CFS	BACKWATER HEAD ELEVATION	DEPTH OF FLOW IN CHANNEL	INVERT IN	INVERT OUT
Griffin Avenue Culvert	Headwall Modification	340	152.5	-	147.3	147.4
Platt Street Culvert	Concrete Wall	374	131.2	-	124.0	121.4
Valley Avenue Culvert	10' x 4' Concrete Box Culvert	384	103.4	-	97.4	97.1
Valley Avenue Channel	10' Wide Earth Channel 1 on 2 Side Slopes	384	-	4.0	-	-
Chopsy Hill Road Culvert	10' x 4' Concrete Box Culvert	393	61.4	-	55.0	54.7
Chopsy Hill Road to Pond Street Channel	8' Wide Earth Channel	398	-	3.5	-	-
Pond Street Culvert	7' x 5' Concrete Box Culvert	398	58.6	-	52.0	51.0
Pitt Street to Woodrow Avenue Culvert	7' x 4' Concrete Box Culvert	300	67.8	-	62.0	51.0
Woodrow Avenue to Saunders Avenue	12' Wide Concrete Channel Vertical Sides	614	-	3.0	-	-
Saunders Avenue Culvert	12' x 6' Concrete Box Culvert	614	55.6	-	47.5	47.0
South of Saunders Avenue Channel	12' Wide Earth Channel 1 on 1.5 Side Slopes	620	-	4.5	-	-
South of Saunders Avenue to Junction Chamber-Culvert	9' x 6' Concrete Box Culvert	620	52.0	-	43.3	42.5
Junction Chamber to Existing Channel	4' x 2.5' Concrete Box Culvert	180	47.5	-	42.5	35.6
Junction Chamber to Summit Street	7' x 5' Concrete Box Culvert	440	47.5	-	42.5	30.0
South of Summit Street Channel	20' Wide Earth Channel 1 on 1.5 Side Slopes	790	-	5.0	-	-
Cemetery Road	None	1050	22.0	-	12.7	12.7

HYDRAULIC SUMMARY

ALTERNATE 1 (Cont'd...)

LOCATION & DESCRIPTION	RECOMMENDED IMPROVEMENT	DESIGN FLOW CFS	BACKWATER HEAD ELEVATION	DEPTH OF FLOW IN CHANNEL	INVERT IN	INVERT OUT
Capitol Avenue to North Avenue Culvert	None	1050	14.5	-	7.4	1.8
North Avenue to Poquonock River Channel	25' Wide Earth Channel 1 on 1-1/2 Side Slopes	1080	-	6.0	-	-

HYDRAULIC SUMMARY

ALTERNATE 2

SAME AS ALTERNATE 1, EXCEPT AS FOLLOWS:

LOCATION & DESCRIPTION	RECOMMENDED IMPROVEMENT	DESIGN FLOW CFS	BACKWATER HEAD ELEVATION	DEPTH OF FLOW IN CHANNEL	INVERT IN	INVERT OUT
South of Saunders Avenue to Summit Street Culvert	9' x 6' Concrete Box Culvert in Existing Channel	620	52.0	-	43.3	30.0

HYDRAULIC SUMMARY

ALTERNATE 3

SAME AS ALTERNATE 1, EXCEPT AS FOLLOWS:

LOCATION & DESCRIPTION	RECOMMENDED IMPROVEMENT	DESIGN FLOW CFS	BACKWATER HEAD ELEVATION	DEPTH OF FLOW IN CHANNEL	INVERT IN	INVERT OUT
Pond Street to Summit Street Culvert	7' x 5' Concrete Box Culvert in Pond St.	398	58.6	-	52.0	30.0
Woodrow Avenue to Saunders Avenue Channel	Concrete Wall & Cement Plaster Existing Stone Masonry Wall	300	-	3.5	-	-
Saunders Avenue Culvert	10' x 5' Concrete Box Culvert	320	55.6	-	48.5	48.0
Saunders Avenue to Summit Street Channel	Concrete Wall	340	-	4.0	-	-

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ALTERNATE PROPOSALS

Three proposals have been studied to relieve flooding between Woodrow Avenue and Summit Street. Alternate No. 1 is described in the Hydraulic Analysis section under Channel between Saunders Avenue and Chopsy Hill Road at Summit Street. Alternate No. 1 is shown on Sheet Nos. 1 to 11, inclusive, of plans included with this report.

Alternate No. 2 is similar to Alternate No. 1, except that rather than construct a junction chamber and divert the majority of flow into a new culvert in Pond Street and Chopsy Hill Road, with low flows remaining in the existing channels and structures, a 9' x 6' culvert following the existing channel alignment approximately 1,030' in length is proposed. This is shown on Sheet No. 12 of plans included with this report.

Alternate No. 3 proposes two separate systems for drainage between Woodrow Avenue and Summit Street. A 7' x 5' culvert from the intersection of Pond Street and Woodrow Avenue to Chopsy Hill and Summit Street, approximately 1,930' in length, is proposed for the flow from Lake Forest and the western portion of the drainage area. The flow from Pitt Street and the eastern portion of the drainage area would be accommodated in the existing channels and culverts. In order to convey the flow in the existing channels and culverts, a channel constriction approximately 160' upstream from the Saunders Avenue culvert should be widened. The Saunders Avenue culvert should be replaced with a 10' x 5' concrete box culvert at a lower invert and additional concrete walls are required approximately 700' upstream from the Summit Street culvert. Alternate No. 3 also requires extensive sanitary sewer adjustments. Alternate No. 3 is shown on Sheet Nos. 13 and 14 of plans included in this report.

Of the three proposals studied, Alternate No. 1 is the most economical. In addition, the diversion into the existing channel of a safe controlled flow should be pleasing to the abutting property owners.

A large portion of the work has been located in the street right-of-way of Pond Street and Chopsy Hill Road, eliminating some of the need to obtain property agreements and minimizing disturbance to residents by construction in back yards. Between Woodrow Avenue and Saunders Avenue, an extensive channel improvement is required for Alternates No. 1 and No. 2. Construction in this area will require easements and will be disruptive to the adjacent property owners.

Alternate No. 2 was studied to investigate the potential savings in excavation and street repaving available by following the alignment of the existing channel. Since this alignment replaced the existing culverts and channel, it requires larger culvert than Alternate No. 1, 9' x 6' for Alternate No. 2 versus 7' x 5' for Alternate No. 1. Our Construction Cost Estimate indicates that the increased cost of the larger culvert exceeds the saving of excavation and paving costs, by approximately $40,000.00.

The purpose of Alternate No. 3 was to develop a scheme that would eliminate the need for any work outside the existing street right-of-ways. It was determined that this objective could not be reached economically, but the work required along the existing channels was greatly reduced.

Alternate No. 3 requires a new concrete box culvert in the right-of-way of Pond Street and Chopsy Hill Road. Following this alignment is expensive since Pond Street and Chopsy Hill Road are on ledge rock in this area.

Pond Street crosses two low ridges between Woodrow Avenue and Summit Street. The topography requires that the proposed culvert be placed at a depth greater than minimum across the ridges further increasing the cost of Alternate No. 3. The alignment interferes with the sanitary sewer connections from the east, requiring an additional parallel sanitary sewer system to be constructed.

In view of the conditions noted, we recommend that Alternate No. 1 be selected for construction.

ISLAND BROOK

CONSTRUCTION COST ESTIMATE (ALTERNATE NO. 1)

S U M M A R Y

LOCATION	DESCRIPTION	AMOUNT
GRIFFIN AVENUE	Headwall Modification	$ 5,000.00
PLATT STREET	Concrete Wall	18,000.00
VALLEY AVENUE	Culvert	40,000.00
VALLEY AVENUE	Channel Improvement	6,000.00
CHOPSY HILL RD. & WOODROW AVE.	Culvert	62,000.00
CHOPSY HILL RD. & WOODROW AVE.	Channel Improvement	4,000.00
CHOPSY HILL ROAD TO POND STREET	Channel Improvement	8,000.00
POND STREET	Culvert	87,000.00
[illegible]T STREET TO WOODROW AVENUE	Culvert	250,000.00
WOODROW AVE. TO SAUNDERS AVE.	Channel Improvement	154,000.00
SAUNDERS AVENUE	Culvert	54,000.00
SOUTH OF SAUNDERS AVENUE	Channel Improvement	25,000.00
SOUTH OF SAUNDERS AVE. TO SUMMIT STREET	Culvert	600,000.00
SOUTH OF SUMMIT STREET	Channel Improvement	53,000.00
NORTH AVE. TO POQUONOCK RIVER	Channel Improvement	89,000.00
TOTAL CONSTRUCTION COST OF PROJECT		$1,455,000.00

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SEELYE STEVENSON VALUE & KNECHT, INC.

ISLAND BROOK

CONSTRUCTION COST ESTIMATE (ALTERNATE NO. 1)

LOCATION - GRIFFIN AVENUE CULVERT

WORK REQUIRED: Improvement of Upstream Headwall and Install Flap Gate

ITEM	UNIT	UNIT PRICE	QUANTITY	AMOUNT
Install Flap Gate	L.S.	200.00	L.S.	$200.00
Structure Excavation - Earth	C.Y.	6.00	12	72.00
Removal of Existing Masonry	C.Y.	20.00	8	160.00
Concrete	C.Y.	200.00	18	3,600.00
Reinforcing Steel	LB.	0.30	1,500	450.00
				$4,482.00
	+ 10%+ Contingency			518.00
	COST			$5,000.00

LOCATION - PLATT STREET CULVERT

WORK REQUIRED: Replace Existing Masonry Wall with New Concrete Wall

ITEM	UNIT	UNIT PRICE	QUANTITY	AMOUNT
ucture Excavation - Earth	C.Y.	6.00	120	$720.00
ructure Excavation - Rock	C.Y.	15.00	100	1,500.00
Removal of Existing Masonry	C.Y.	20.00	35	700.00
Concrete	C.Y.	200.00	60	12,000.00
Reinforcing Steel	LB.	0.30	5,000	1,500.00
Dampproofing	S.Y.	2.00	80	160.00
				$16,580.00
	+ 10%+ Contingency			1,420.00
	COST			$18,000.00

LOCATION - VALLEY AVENUE CULVERT

WORK REQUIRED: Replace Existing Culvert with 10' x 4' Concrete Box Culvert - 50' Long

ITEM	UNIT	UNIT PRICE	QUANTITY	AMOUNT
Structure Excavation - Earth	C.Y.	6.00	240	$1,440.00
Structure Excavation - Rock	C.Y.	15.00	140	2,100.00
Concrete	C.Y.	200.00	85	17,000.00
Reinforcing Steel	LB.	0.30	10,000	3,000.00
Dampproofing	S.Y.	2.00	150	300.00
Pervious Structure Backfill	C.Y.	8.00	130	1,040.00
Gravel Fill	C.Y.	6.00	60	360.00
Paving	S.Y.	9.00	100	900.00
Relocate 8" Watermain	L.F.	20.00	40	800.00
ust Sanitary Sewer	L.S.	10,000.00	NEC.	10,000.00
				$36,940.00
	+ 10%+ Contingency			3,060.00
	COST			$40,000.00

'LAND BROOK - CONSTRUCTION COST ESTIMATE (ALTERNATE NO. 1) Cont'd....

LOCATION - VALLEY AVENUE CHANNEL

WORK REQUIRED: Lower and Widen Approximately 50' Upstream and 250' Downstream Earth Channel, 10' Bottom, 2:1 Side Slope

ITEM	UNIT	UNIT PRICE	QUANTITY	AMOUNT
Channel Excavation - Earth	C.Y.	3.00	550	$1,650.00
Channel Excavation - Rock	C.Y.	7.00	150	1,050.00
Modified Rip Rap	TON	20.00	120	2,400.00
				$5,100.00
	+ 10%+ Contingency			900.00
	COST			$6,000.00

LOCATION - CHOPSY HILL ROAD AT WOODROW AVENUE CULVERT

WORK REQUIRED: Replace Existing Culvert with New 10' x 4' Concrete Box Culvert, 50' Long, and Extend Upstream Wingwall on North Side Approximately 100'

ITEM	UNIT	UNIT PRICE	QUANTITY	AMOUNT
Structure Excavation - Earch	C.Y.	6.00	450	$2,700.00
ıcrete	C.Y.	200.00	150	30,000.00
einforcing Steel	LB.	0.30	20,000	6,000.00
Paving	S.Y.	9.00	70	630.00
Pervious Structure Backfill	C.Y.	8.00	150	1,200.00
Gravel Fill	C.Y.	6.00	60	360.00
Dampproofing	S.Y.	2.00	180	360.00
Asjust Sanitary Sewer	L.S.	15,000.00	NEC.	15,000.00
				$56,250.00
	+ 10%+ Contingency			5,750.00
	COST			$62,000.00

LOCATION - CHOPSY HILL ROAD AT WOODROW AVENUE CHANNEL

WORK REQUIRED: Lower and Widen Upstream Channel, 10' Bottom Width, Length Approximately 130'

ITEM	UNIT	UNIT PRICE	QUANTITY	AMOUNT
Channel Excavation - Earth	C.Y.	3.00	250	$750.00
Intermediate Rip Rap	TONS	25.00	120	3,000.00
				$3,750.00
	+ 10%+ Contingency			250.00
	COST			$4,000.00

LAND BROOK - CONSTRUCTION COST ESTIMATE (ALTERNATE NO. 1) Cont'd.....

LOCATION - CHANNEL BETWEEN CHOPSY HILL ROAD AND POND STREET

WORK REQUIRED: Lower and Widen Existing Channel, 8' Bottom Width - Length Approximately 300'

ITEM	UNIT	UNIT PRICE	QUANTITY	AMOUNT
Channel Excavation - Earth	C.Y.	3.00	900	$2,700.00
Modified Rip Rap	TON	20.00	250	5,000.00
				$7,700.00
	+ 10%+ Contingency			300.00
	COST			$8,000.00

LOCATION - POND STREET CULVERT

WORK REQUIRED: Replace Existing Culvert with 7' x 5' Concrete Box Culvert - Approximately 135' Long

ITEM	UNIT	UNIT PRICE	QUANTITY	AMOUNT
Structure Excavation - Earth	C.Y.	6.00	600	$3,600.00
Structure Excavation - Rock	C.Y.	15.00	400	6,000.00
Concrete	C.Y.	200.00	180	36,000.00
Reinforcing Steel	LB.	0.30	25,000	7,500.00
Dampproofing	S.Y.	2.00	320	640.00
Pervious Structure Backfill	C.Y.	8.00	800	6,400.00
Gravel Fill	C.Y.	6.00	130	780.00
Paving	S.Y.	9.00	400	3,600.00
Adjust Sanitary Sewer	L.S.	15,000.00	NEC.	15,000.00
				$79,520.00
	+ 10%+ Contingency			7,480.00
	COST			$87,000.00

LAND BROOK - CONSTRUCTION COST ESTIMATE (ALTERNATE NO. 1) Cont'd.....

LOCATION - PITT STREET TO WOODROW AVENUE CULVERT

WORK REQUIRED: Replace Existing Culverts and Open Channels with Junction Chamber in Pitt Street and 7' x 4' Concrete Box Culvert from Junction Chamber to Woodrow Avenue - Approximate Length 630'

ITEM	UNIT	UNIT PRICE	QUANTITY	AMOUNT
Structure Excavation - Earth	C.Y.	6.00	1,900	$11,400.00
Structure Excavation - Rock	C.Y.	15.00	500	7,500.00
Concrete	C.Y.	200.00	680	136,000.00
Reinforcing Steel	LB.	0.30	105,000	31,500.00
Dampproofing	S.Y.	2.00	1,200	2,400.00
Pervious Structure Backfill	C.Y.	8.00	1,400	11,200.00
Gravel Fill	C.Y.	6.00	600	3,600.00
Paving	S.Y.	9.00	270	2,430.00
Topsoiling and Seeding	S.Y.	1.50	1,200	1,800.00
Adjust Sanitary Sewer	L.S.	20,000.00	NEC.	20,000.00
				$227,830.00
	+ 10%+ Contingency			22,170.00
	COST			$250,000.00

LOCATION - WOODROW AVENUE TO SAUNDERS AVENUE CHANNEL

WORK REQUIRED: Improve Existing Open Channel with a 12' Wide Concrete Walled Channel Approximately 460'

ITEM	UNIT	UNIT PRICE	QUANTITY	AMOUNT
Structure Excavation - Earth	C.Y.	6.00	1,100	$6,600.00
Structure Excavation - Rock	C.Y.	15.00	300	4,500.00
Concrete	C.Y.	200.00	500	100,000.00
Reinforcing Steel	LB.	0.30	60,000	18,000.00
Pervious Structure Backfill	C.Y.	8.00	700	5,600.00
Gravel Fill	C.Y.	6.00	600	3,600.00
Topsoil and Seeding	S.Y.	1.50	1,000	1,500.00
				$139,800.00
	+ 10%+ Contingency			14,200.00
	COST			$154,000.00

ISLAND BROOK - CONSTRUCTION COST ESTIMATE (ALTERNATE NO. 1) Cont'd....

L ATION - SAUNDERS AVENUE CULVERT

WORK REQUIRED: Replace Existing Culvert with 12' x 6' Concrete Box Culvert Approximately 55' Long

ITEM	UNIT	UNIT PRICE	QUANTITY	AMOUNT
Structure Excavation - Earth	C.Y.	6.00	400	$2,400.00
Structure Excavation - Rock	C.Y.	15.00	80	1,200.00
Concrete	C.Y.	200.00	110	22,000.00
Reinforcing Steel	LB.	0.30	17,000	5,100.00
Dampproofing	S.Y.	2.00	170	340.00
Pervious Structure Backfill	C.Y.	8.00	180	1,440.00
Gravel Fill	C.Y.	6.00	80	480.00
Paving	S.Y.	9.00	120	1,080.00
Adjust Sanitary Sewer	L.S.	15,000.00	NEC.	15,000.00
				$49,040.00
	+ 10%+ Contingency			4,960.00
	COST			$54,000.00

LOCATION - CHANNEL - SOUTH OF SAUNDERS AVENUE

WORK REQUIRED: Deepen Existing Open Channel - Minimum Width - 12' - Length 450'

ITEM	UNIT	UNIT PRICE	QUANTITY	AMOUNT
Channel Excavation - Earth	C.Y.	3.00	800	$2,400.00
M ified Riprap	TON	20.00	1,000	20,000.00
				$22,400.00
	+ 10%+ Contingency			2,600.00
	COST			$25,000.00

LOCATION - CULVERT FROM SOUTH OF SAUNDERS AVENUE TO SUMMIT STREET

WORK REQUIRED: 250' of 9' x 6' Concrete Box Culvert Junction Chamber - 55' of 4' x 2'-6" Box Culvert, 710' of 7' x 5' Concrete Box Culvert

ITEM	UNIT	UNIT PRICE	QUANTITY	AMOUNT
Structure Excavation - Earth	C.Y.	6.00	3,800	$22,800.00
Structure Excvation - Roch	C.Y.	15.00	2,700	40,500.00
Concrete	C.Y.	200.00	1,550	310,000.00
Reinforcing Steel	LB.	0.30	230,000	69,000.00
Dampproofing	S.Y.	2.00	2,400	4,800.00
Pervious Structure Backfill	C.Y.	8.00	3,750	30,000.00
Gravel Fill	C.Y.	6.00	1,000	6,000.00
Paving	S.Y.	9.00	2,100	18,900.00
Trench Excavation - Earth	C.Y.	10.00	500	5,000.00
Trench Excavation - Rock	C.Y.	20.00	1,000	20,000.00
30" Sanitary Sewer	L.F.	40.00	450	18,000.00
				$545,000.00
	+ 10%+ Contingency			55,000.00
	COST			$600,000.00

"SLAND BROOK - CONSTRUCTION COST ESTIMATE (ALTERNATE NO. 1) Cont'd.....

LOCATION - CHANNEL SOUTH OF SUMMIT STREET

WORK REQUIRED: Deepen Existing Channel Approximately 650' - 20' Minimum Bottom Width

ITEM	UNIT	UNIT PRICE	QUANTITY	AMOUNT
Channel Excavation - Earth	C.Y.	3.00	2,100	$6,300.00
Intermediate Rip Rap	TON	25.00	1,700	42,500.00
				$48,800.00
+ 10%± Contingency				4,200.00
COST				$53,000.00

LOCATION - NORTH AVENUE TO POQUONOCK RIVER

WORK REQUIRED: Deepen and Widen Existing Channel Approximately 360' - 25' Minimum Bottom Width, add Concrete Wall 60' Long

ITEM	UNIT	UNIT PRICE	QUANTITY	AMOUNT
Channel Excavation - Earth	C.Y.	3.00	2,000	$6,000.00
Modified Riprap	TONS	20.00	3,000	60,000.00
Structure Excavation	C.Y.	6.00	220	1,320.00
Concrete	C.Y.	200.00	60	12,000.00
Reinforcing Steel	LB.	0.30	5,000	1,500.00
				$80,820.00
+ 10%± Contingency				8,180.00
COST				$89,000.00

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ISLAND BROOK

CONSTRUCTION COST ESTIMATE (ALTERNATE NO. 2)

S U M M A R Y

LOCATION	DESCRIPTION	AMOUNT
GRIFFIN AVENUE	Headwall Modification	$ 5,000.00
PLATT STREET	Concrete Wall	18,000.00
VALLEY AVENUE	Culvert	40,000.00
VALLEY AVENUE	Channel Improvement	6,000.00
CHOPSY HILL RD. & WOODROW AVE.	Culvert	62,000.00
CHOPSY HILL RD. & WOODROW AVE.	Channel Improvement	4,000.00
CHOPSY HILL ROAD TO POND STREET	Channel Improvement	8,000.00
POND STREET	Culvert	87,000.00
T STREET TO WOODROW AVENUE	Culvert	250,000.00
WOODROW AVE. TO SAUNDERS AVE.	Channel Improvement	154,000.00
SAUNDERS AVENUE	Culvert	54,000.00
SOUTH OF SAUNDERS AVENUE	Channel Improvement	25,000.00
SOUTH OF SAUNDERS AVENUE TO SUMMIT STREET	Culvert	640,000.00
SOUTH OF SUMMIT STREET	Channel Improvement	53,000.00
NORTH AVE. TO POQUONOCK RIVER	Channel Improvement	89,000.00
TOTAL CONSTRUCTION COST OF PROJECT		$1,495,000.00

ISLAND BROOK

CONSTRUCTION COST ESTIMATE (ALTERNATE NO. 2)

LOCATION - CULVERT FROM SOUTH OF SAUNDERS AVENUE TO SUMMIT STREET

WORK REQUIRED: 1,030' of 9' x 6' Concrete Box Culvert

ITEM	UNIT	UNIT PRICE	QUANTITY	AMOUNT
Structure Excavation - Earth	C.Y.	$6.00	4,500	$27,000.00
Structure Excavation - Rock	C.Y.	15.00	500	7,500.00
Concrete	C.Y.	200.00	1,900	380,000.00
Reinforcing Steel	LB.	0.30	270,000	81,000.00
Dampproofing	S.Y.	2.00	2,800	5,600.00
Paving	S.Y.	9.00	1,100	9,900.00
Trench Excavation - Earth	C.Y.	10.00	500	5,000.00
Trench Excavation - Rock	C.Y.	20.00	1,000	20,000.00
30" Sanitary Sewer	L.F.	40.00	450	18,000.00
Pervious Structure Backfill	C.Y.	8.00	2,100	16,800.00
Gravel Fill	C.Y.	6.00	1,200	7,200.00
				$578,000.00
		+ 10%+ Contingency		62,000.00
		COST		$640,000.00

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ISLAND BROOK

CONSTRUCTION COST ESTIMATE (ALTERNATE NO. 3)

S U M M A R Y

LOCATION	DESCRIPTION	AMOUNT
GRIFFIN AVENUE	Headwall Modification	$ 5,000.00
PLATT STREET	Concrete Wall	18,000.00
VALLEY AVENUE	Culvert	40,000.00
VALLEY AVENUE	Channel Improvement	6,000.00
CHOPSY HILL RD. & WOODROW AVE.	Culvert	62,000.00
CHOPSY HILL RD. & WOODROW AVE.	Channel Improvement	4,000.00
CHOPSY HILL ROAD TO POND STREET	Channel Improvement	8,000.00
WOODROW AVENUE TO SUMMIT STREET	Culvert	1,122,000.00
PITT STREET TO WOODROW AVENUE	Culvert	250,000.00
WOODROW AVE. TO SAUNDERS AVE.	Channel Improvement	14,000.00
SAUNDERS AVENUE	Culvert	50,000.00
SAUNDERS AVE. TO SUMMIT STREET	Channel Improvement	15,000.00
SOUTH OF SUMMIT STREET	Channel Improvement	53,000.00
NORTH AVE. TO POQUONOCK RIVER	Channel Improvement	89,000.00
TOTAL CONSTRUCTION COST OF PROJECT		$1,736,000.00

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ISLAND BROOK

CONSTRUCTION COST ESTIMATE (ALTERNATE NO. 3)

LOCATION - SAUNDERS AVENUE TO SUMMIT STREET CHANNEL

WORK REQUIRED: Deepen Channel Downstream from Saunders Avenue Culvert, add 100' Concrete Walls

ITEM	UNIT	UNIT PRICE	QUANTITY	AMOUNT
Channel Excavation - Earth	C.Y.	$3.00	75	225.00
Structure Excavation - Earth	C.Y.	6.00	200	1,200.00
Concrete	C.Y.	200.00	50	10,000.00
Reinforcing Steel	LB.	0.30	6,000	1,800.00
Dampproofing	S.Y.	2.00	50	100.00
Pervious Structure Backfill	C.Y.	8.00	60	480.00
				$13,805.00
		+ 10%± Contingency		1,195.00
		COST		$15,000.00

LOCATION - WOODROW AVENUE TO SAUNDERS AVENUE CHANNEL

WORK REQUIRED: Face Existing Stone Wall with Cement Plaster, Approximtely 120' in Length, Replace 80' of Concrete Wall to Widen Channel

ITEM	UNIT	UNIT PRICE	QUANTITY	AMOUNT
Structure Excavation - Earth	C.Y.	$6.00	150	900.00
Concrete	C.Y.	200.00	40	8,000.00
Reinforcing Steel	LB.	0.30	5,000	1,500.00
Dampproofing	S.Y.	2.00	45	90.00
Pervious Structure Backfill	C.Y.	8.00	50	400.00
Cement Facing	S.Y.	35.00	60	2,100.00
				$12,990.00
		+ 10%± Contingency		1,010.00
		COST		$14,000.00

LOCATION - SAUNDERS AVENUE CULVERT

WORK REQUIRED: Replace Existing Culvert with 10' x 5' Concrete Box Culvert, Approximately 55' Long

ITEM	UNIT	UNIT PRICE	QUANTITY	AMOUNT
Structure Excavation - Earth	C.Y.	$6.00	320	1,920.00
Structure Excavation - Rock	C.Y.	15.00	70	1,050.00
Concrete	C.Y.	200.00	100	20,000.00
Reinforcing Steel	LB.	0.30	15,000	4,500.00
Dampproofing	S.Y.	2.00	150	300.00
Pervious Structure Backfill	C.Y.	8.00	160	1,280.00
Gravel Fill	C.Y.	6.00	70	420.00
Paving	S.Y.	9.00	120	1,080.00
Adjust Sanitary Sewer	L.S.	15,000.00	NEC.	15,000.00
				$45,550.00
		+ 10%± Contingency		4,450.00
		COST		$50,000.00

.AND BROOK - CONSTRUCTION COST ESTIMATE (ALTERNATE NO. 3) Cont'd.....

LOCATION - WOODROW AVENUE TO SUMMIT STREET CULVERT

WORK REQUIRED: 7' x 5' Concrete Box Culvert, 1,930' Long

ITEM	UNIT	UNIT PRICE	QUANTITY	AMOUNT
Structure Excavation - Earth	C.Y.	$6.00	2,800	$16,800.00
Structure Excavation - Rock	C.Y.	15.00	9,800	147,000.00
Concrete	C.Y.	200.00	2,400	480,000.00
Reinforcing Steel	LB.	0.30	360,000	108,000.00
Dampproofing	S.Y.	2.00	4,200	8,400.00
Pervious Structure Backfill	C.Y.	8.00	9,000	72,000.00
Gravel Fill	C.Y.	6.00	1,500	9,000.00
Paving	S.Y.	9.00	4,000	36,000.00
12" Sanitary Sewer	L.F.	20.00	600	12,000.00
18" Sanitary Sewer	L.F.	25.00	1,200	30,000.00
30" Sanitary Sewer	L.F.	40.00	450	18,000.00
Trench Excavation - Earth	C.Y.	10.00	1,300	13,000.00
Trench Excavation - Rock	C.Y.	20.00	3,500	70,000.00
				$1,020,200.00
		+ 10%+ Contingency		101,800.00
		COST		$1,122,000.00

CONSTRUCTION PRIORITIES

The residents of the Island Brook area experience some inconvenience during most storms. The report indicates that all culverts except the recently constructed culvert under Route 25 and North Avenue require either replacement or some alteration to adequately convey the design flows. The report also shows that channel improvements are required in areas where various construction has constricted the flood plain. Reports by other Engineers have noted the need to enlarge the spillway at Lake Forest and our analysis confirms their findings and also shows that the spillway at Charcoal Pond requires improvement. The spillways are owned by private Associations, and it is the owner's responsibility to correct the deficiencies of the spillways.

Currently, the most severe flooding in the watershed is at Pitt Street, Douglas Street and Pond Street above Woodrow Avenue, and Chopsy Hill Road at Woodrow Avenue. The flooding in these areas will be relieved by the construction of the Saunders Avenue culvert, the channel improvement between Woodrow Avenue and Saunders Avenue, the Pitt Street to Woodrow Avenue culvert, the Pond Street culvert, the channel improvement between Chopsy Hill Road and Pond Street and the Chopsy Hill Road culvert. If only this work is done, the area between Saunders Avenue and Summit Street, which now is flooded less severely than the area above Woodrow Avenue, will experience increased flooding. In addition to the above noted work, the culvert from south of Saunders Avenue to Summit Street and the channel improvement south of Summit Street is recommended to be included in the first priority of work.

The existing culverts at Griffin Avenue, Platt Street and Valley Avenue are adequate if the spillway at Lake Forest and Charcoal Pond are not improved. The structures and channel work at Valley Avenue could be scheduled concurrently with the spillway reconstructions.

The area between North Avenue and the Poquonock River currently experiences only minor flooding. The existing channel has been used as a disposal site. Shopping carts, tires, refrigerators and other miscellaneous litter in the channel contribute to the flooding. Removal of debris in the channel could be considered as a first priority item of work and the channel improvement as a later work item.

It is apparent from our studies that only 10% of the work could be deferred for future construction and still provide reasonable relief to the current flooding conditions in the Island Brook watershed. It is, therefore, recommended that all the work proposed be constructed as one project.

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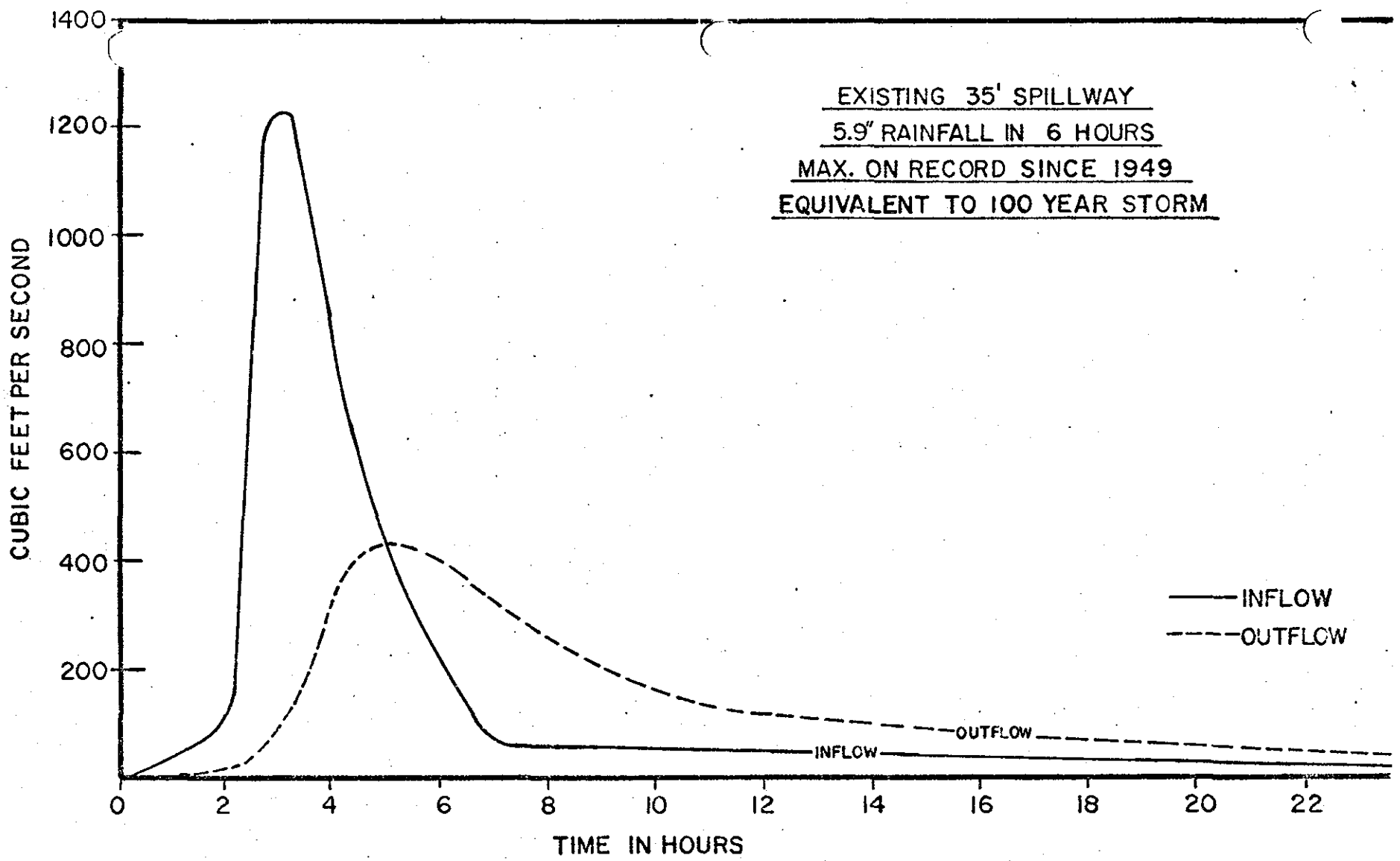
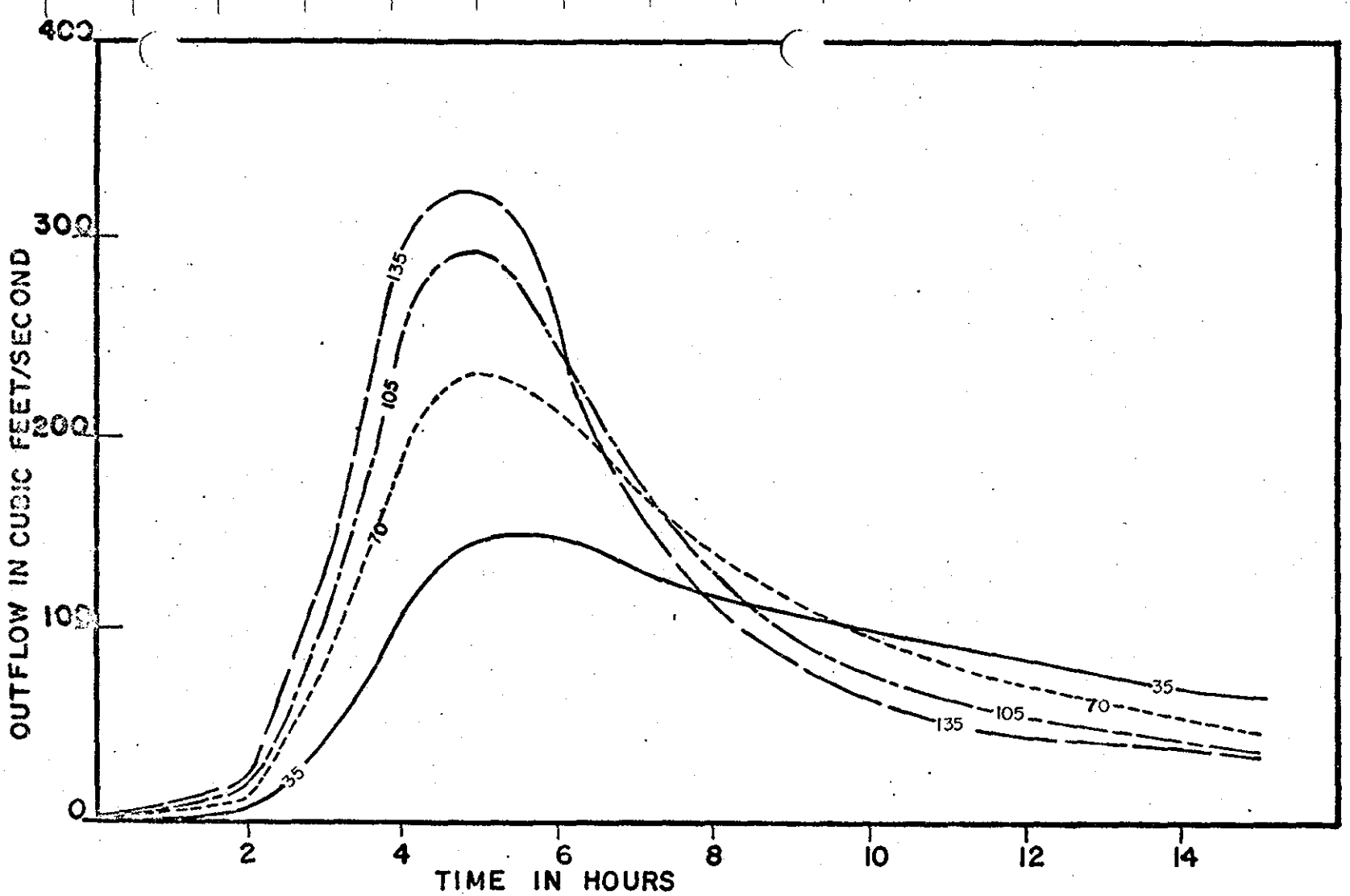


FLOOD ROUTING
LAKE FOREST

B-130

PLATE

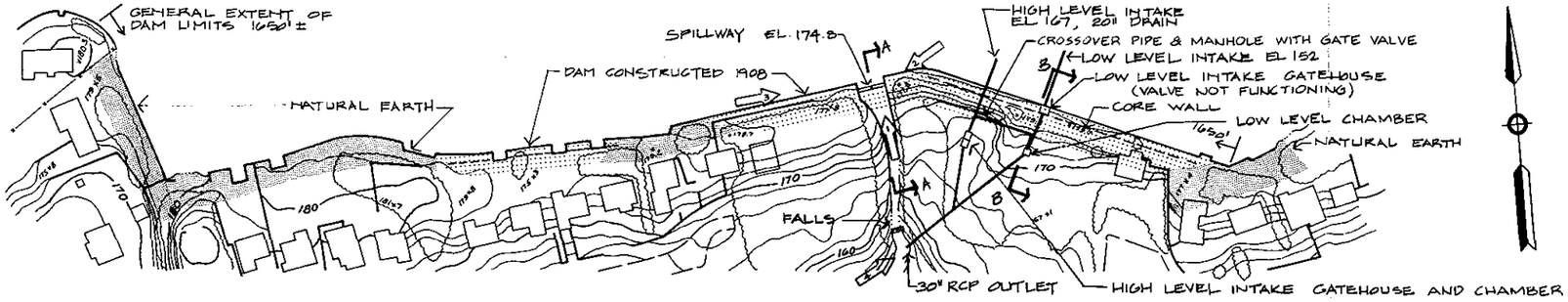


OUTFLOW FOR VARIOUS SPILLWAY WIDTHS

25 YEAR — 6 HOUR STORM

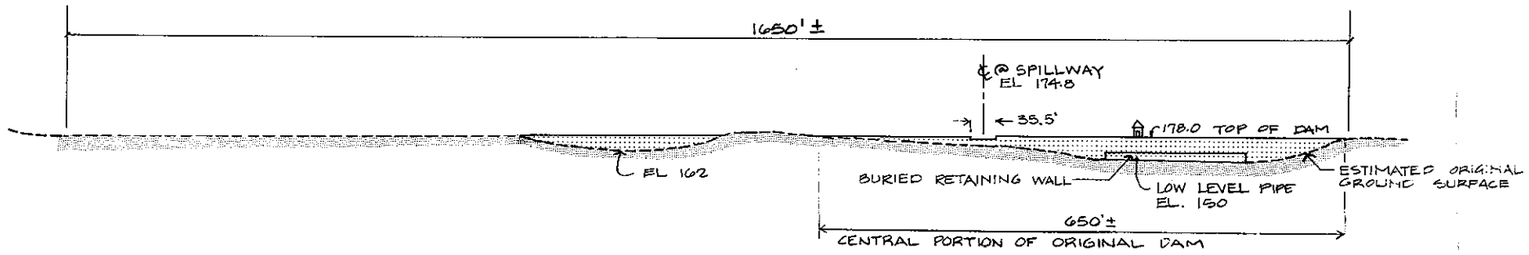
B-131

PLATE N



PLAN

100' 0 100' 200'

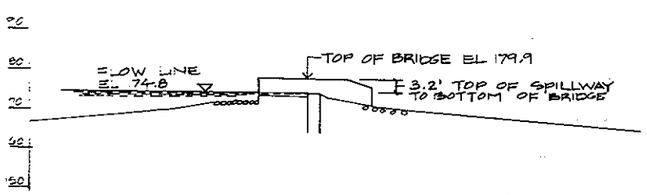


PROFILE

100' 0 100' 200'

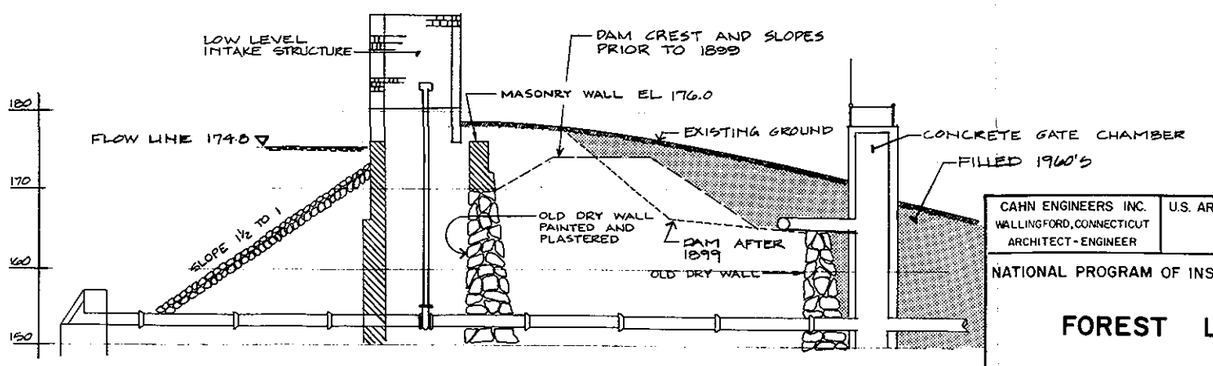
NOTE: ALL INFORMATION SHOWN HEREIN HAS BEEN COMPILED FROM EXISTING RECORDS & VISUAL OBSERVATIONS.

⇨ PHOTO NUMBER AND DIRECTION



SECTION A-A THRU SPILLWAY

20' 0 20' 40



SECTION B-B THRU LOW LEVEL INTAKE

10' 0 10' 20'

CAHN ENGINEERS INC. WALLINGFORD, CONNECTICUT ARCHITECT-ENGINEER			U.S. ARMY ENGINEER DIV. NEW ENGLAND CORP OF ENGINEERS WALTHAM, MASS.
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS			
FOREST LAKE DAM			
ISLAND BROOK			BRIDGEPORT, CONNECTICUT
DRBY	CHKBY	APP BY	SCALE: AS NOTED
JA	DAM	DmH	DATE: 5/23/78 — PAGE B-151

APPENDIX

SECTION C: DETAIL PHOTOGRAPHS

PHOTO NO.1 - Outlet spillway channel, note tree branches and other debris.

PHOTO NO.2 - Embankment at spillway wall.

PHOTO NO. 3 - Riprap, right of spillway, showing vegetation growth.

PHOTO NO. 4 - Outlet conduit, partially obstructed.

APPENDIX

SECTION D: HYDRAULIC/HYDROLOGIC COMPUTATIONS

PRELIMINARY GUIDANCE

FOR ESTIMATING

MAXIMUM PROBABLE DISCHARGES

IN

PHASE I DAM SAFETY

INVESTIGATIONS

New England Division
Corps of Engineers

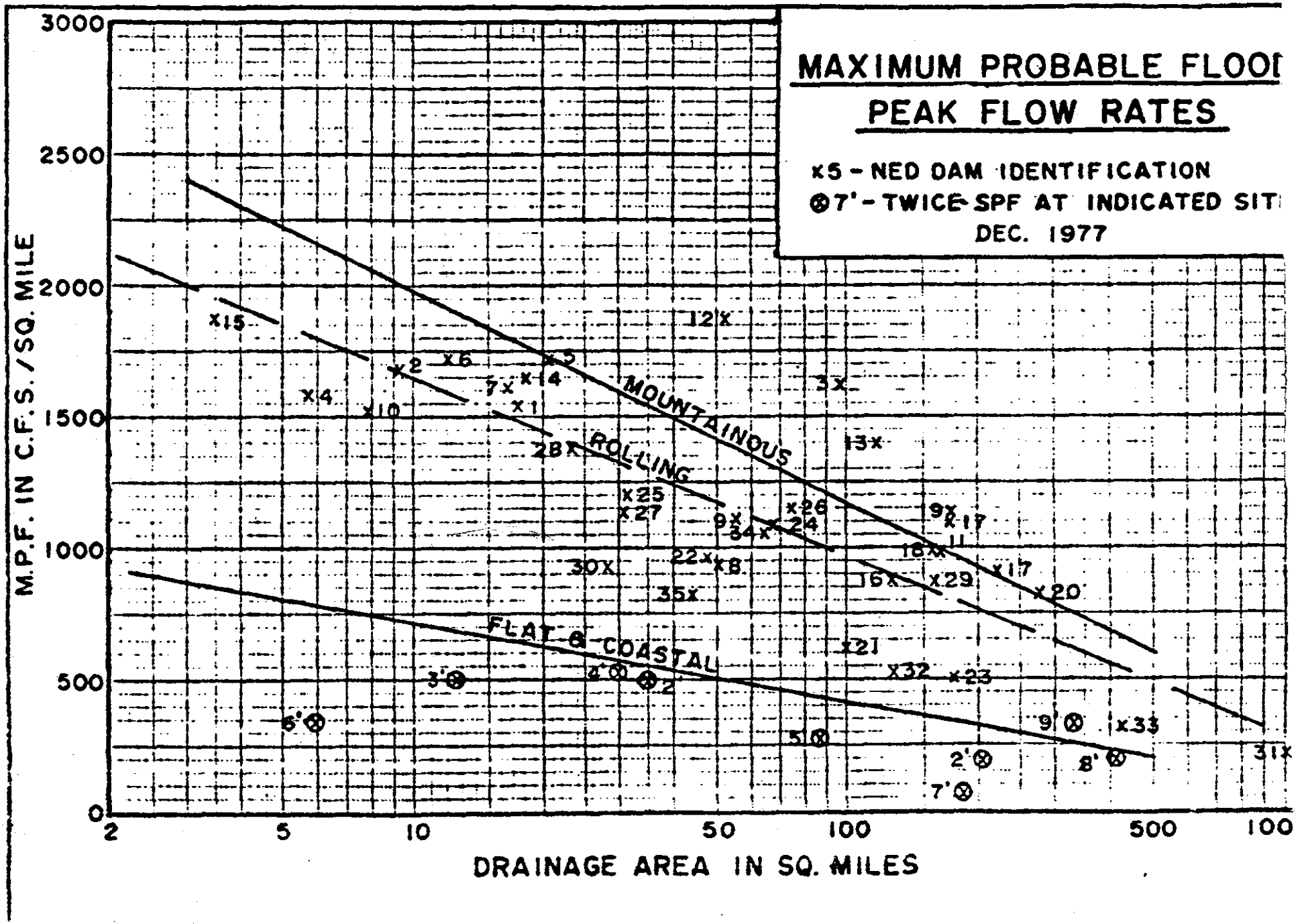
March 1978

MAXIMUM PROBABLE FLOOD INFLOWS
NED RESERVOIRS

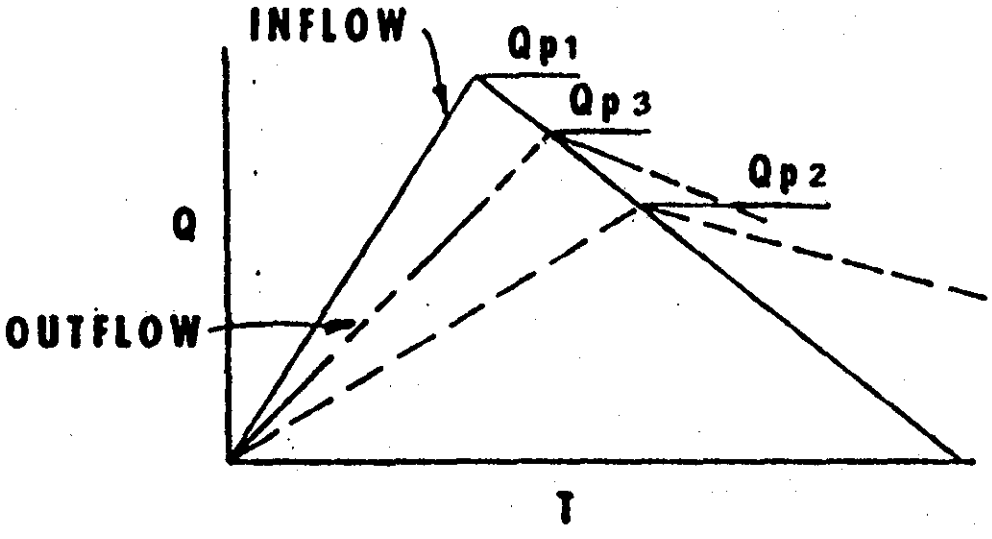
	Project	Q (cfs)	D.A. (sq. mi.)	MPF cfs/sq. mi.
1.	Hall Meadow Brook	26,600	17.2	1,546
2.	East Branch	15,500	9.25	1,675
3.	Thomaston	158,000	97.2	1,625
4.	Northfield Brook	9,000	5.7	1,580
5.	Black Rock	35,000	20.4	1,715
6.	Hancock Brook	20,700	12.0	1,725
7.	Hop Brook	26,400	16.4	1,610
8.	Tully	47,000	50.0	940
9.	Barre Falls	61,000	55.0	1,109
10.	Conant Brook	11,900	7.8	1,525
11.	Knightville	160,000	162.0	987
12.	Littleville	98,000	52.3	1,870
13.	Colebrook River	165,000	118.0	1,400
14.	Mad River	30,000	18.2	1,650
15.	Sucker Brook	6,500	3.43	1,895
16.	Union Village	110,000	126.0	873
17.	North Hartland	199,000	220.0	904
18.	North Springfield	157,000	158.0	994
19.	Ball Mountain	190,000	172.0	1,105
20.	Townshend	228,000	106.0(278 total)	820
21.	Surry Mountain	63,000	100.0	630
22.	Otter Brook	45,000	47.0	957
23.	Birch Hill	88,500	175.0	505
24.	East Brimfield	73,900	67.5	1,095
25.	Westville	38,400	99.5(32 net)	1,200
26.	West Thompson	85,000	173.5(74 net)	1,150
27.	Hodges Village	35,600	31.1	1,145
28.	Buffumville	36,500	26.5	1,377
29.	Mansfield Hollow	125,000	159.0	786
30.	West Hill	26,000	28.0	928
31.	Franklin Falls	210,000	1000.0	210
32.	Blackwater	66,500	128.0	520
33.	Hopkinton	135,000	426.0	316
34.	Everett	68,000	64.0	1,062
35.	MacDowell	36,300	44.0	825

MAXIMUM PROBABLE FLOWS
BASED ON TWICE THE
STANDARD PROJECT FLOOD
(Flat and Coastal Areas)

River	SPF (cfs)	D.A. (sq. mi.)	MPF (cfs/sq. mi.)
1. Pawtuxet River	19,000	200	190
2. Mill River (R.I.)	8,500	34	500
3. Peters River (R.I.)	3,200	13	490
4. Kettle Brook	8,000	30	530
5. Sudbury River.	11,700	86	270
6. Indian Brook (Hopk.)	1,000	5.9	340
7. Charles River.	6,000	184	65
8. Blackstone River.	43,000	416	200
9. Quinebaug River	55,000	331	330


MAXIMUM PROBABLE FLOOI
PEAK FLOW RATES
x5 - NED DAM IDENTIFICATION
⊗7' - TWICE SPF AT INDICATED SIT
DEC. 1977
M.P.F. IN C.F.S./SQ. MILE
DRAINAGE AREA IN SQ. MILES
3000
2500
2000
1500
1000
500
0
2
5
10
50
100
500
MOUNTAINOUS
ROLLING
FLAT & COASTAL
x15
x4
x10
x2
x6
x3
7x
x14
x1
12x
3x
28x
13x
x25
x27
9x
x26
24
34x
9x
x17
11
18x
x17
x20
16x
x29
30x
22x
x8
35x
x21
x32
x23
3'⊗
4'⊗
2
6'⊗
5⊗
9'⊗
x33
2'⊗
8'⊗
7'⊗
31x

ESTIMATING EFFECT OF SURCHARGE STORAGE ON MAXIMUM PROBABLE DISCHARGES



STEP 1: Determine Peak Inflow (Qp_1) from Guide Curves.

STEP 2: a. Determine Surcharge Height To Pass "Qp_1".

b. Determine Volume of Surcharge ($STOR_1$) In Inches of Runoff.

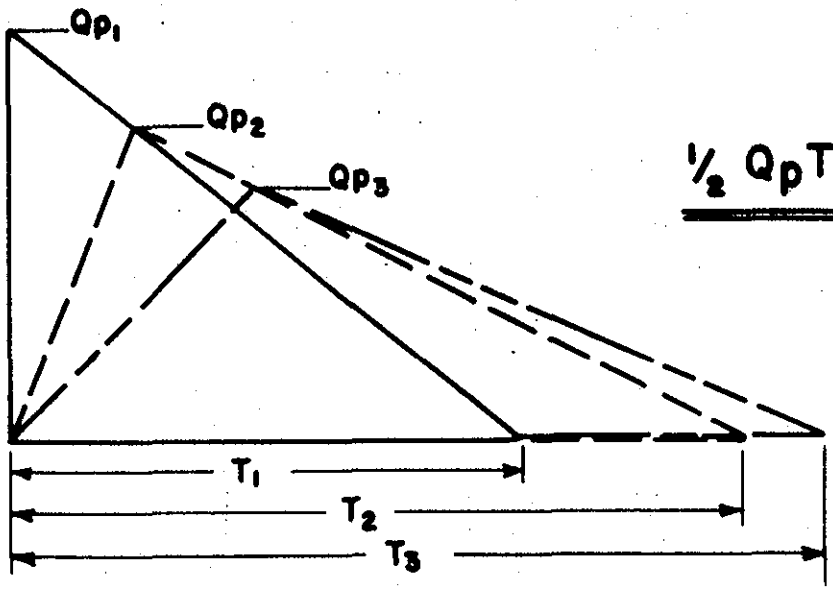
c. Maximum Probable Flood Runoff In New England equals Approx. 19", Therefore

$$Qp_2 = Qp_1 \times \left(1 - \frac{STOR_1}{19}\right)$$

STEP 3: a. Determine Surcharge Height and "$STOR_2$" To Pass "Qp_2"

b. Average "$STOR_1$" and "$STOR_2$" and Determine Average Surcharge and Resulting Peak Outflow "Qp_3".

"RULE OF THUMB" GUIDANCE FOR ESTIMATING DOWNSTREAM DAM FAILURE HYDROGRAPHS



$\frac{1}{2} Q_p T = 12 S$

STEP 1: DETERMINE OR ESTIMATE RESERVOIR STORAGE (S) IN AC-FT AT TIME OF FAILURE.

STEP 2: DETERMINE PEAK FAILURE OUTFLOW (Q_{p1}).

$$Q_{p1} = \frac{8}{27} W_b \sqrt{g} Y_o^{\frac{3}{2}}$$

W_b = BREACH WIDTH - SUGGEST VALUE NOT GREATER THAN 40% OF DAM LENGTH ACROSS RIVER AT MID HEIGHT.

Y_o = TOTAL HEIGHT FROM RIVER BED TO POOL LEVEL AT FAILURE.

STEP 3: USING USGS TOPO OR OTHER DATA, DEVELOP REPRESENTATIVE STAGE-DISCHARGE RATING FOR SELECTED DOWNSTREAM RIVER REACH.

STEP 4: ESTIMATE REACH OUTFLOW (Q_{p2}) USING FOLLOWING ITERATION.

A. APPLY Q_{p1} TO STAGE RATING, DETERMINE STAGE AND ACCOPMANYING VOLUME (V_1) IN REACH IN AC-FT. (NOTE: IF V_1 EXCEEDS 1/2 OF S, SELECT SHORTER REACH.)

B. DETERMINE TRIAL Q_{p2}.

$$Q_{p_2}(\text{TRIAL}) = Q_{p_1}\left(1 - \frac{V_1}{S}\right)$$

C. COMPUTE V_2 USING Q_{p2} (TRIAL).

D. AVERAGE V_1 AND V_2 AND COMPUTE Q_{p2}.

$$Q_{p_2} = Q_{p_1}\left(1 - \frac{V_{avg}}{S}\right)$$

STEP 5: FOR SUCCEEDING REACHES REPEAT STEPS 3 AND 4.

APRIL 1978

HYDROLOGIC / HYDRAULIC INSPECTION

LAKE FOREST DAM EAST BRIDGEPORT, CONN

(1) MAXIMUM PROBABLE FLOOD - PEAK FLOOD RATE

(a) WATERSHED CLASSIFIED AS "MOUNTAINOUS" TYPE

THE MPF GUIDE CURVES FURNISHED BY THE ACE NEW ENGLAND DIV. OFFICE ARE USED FOR THE DETERMINATION OF MPF

(b) WATERSHED AREA: DA = 1.445 SQ. MI (J.W. CONE "INVESTIGATION OF ISLAND BROOK DAM" 6/1/66) C.E. MEASURE CHECKED DA = 1.46 SQ. MI

FOR COMPUTATION, USE 1.45 SQ. MI

(c) FROM GUIDE CURVE. (EXTRAPOLATION)

MPF ≈ 2,650 CFS/SQ. MI

(d) M.P.F = PEAK INFLOW

$Q = 2{,}650 \times 1.45 \approx 3{,}840$ CFS

D-7

(2) SPILLWAY DESIGN FLOOD (SDF)

(a) CLASSIFICATION OF DAM ACCORDING TO ACE RECOMMENDED GUIDELINES.

(1) SIZE (IMPOUNDMENT) STORAGE[1] (MAX) = 908 AC-FT (SMALL)

THE DAM IS CLASSIFIED AS "SMALL". HIGHT[2] = 8 FT (SMALL)

(1) (FROM INVENTORY OF DAMS IN THE UNITED STATES · 3/10/1978. P 10.)
(2) FROM DEP TOPO MAP OF LK. FOREST. 4/12/74 NOTE: 1908 MAP SHOWS HEIGHT ±23' BUT D/S SIDE HAS BEEN FILLED, ACTUALLY REDUCING HEIGHT TO ±8'.

HYDROLOGIC / HYDRAULIC INSPECTION

LAKE FOREST DAM EAST BRIDGEPORT, CONN

(2) (cont'd) SPILLWAY DESIGN FLOOD (SDF)

(ii) HAZARD POTENTIAL.

THE DAM IS LOCATED U/STREAM OF URBAN DEVELOPED AREA OF BRIDGEPORT. THEREFORE, IT IS CLASSIFIED AS OF 'HIGH' HAZARD POTENTIAL

(iii) SDF

ACCORDING TO ACE RECOMMENDED GUIDELINES FOR A DAM OF SMALL SIZE AND HIGH HAZARD POTENTIAL. SDF TO BE USED CAN VARY FROM 1/2 MPF TO MPF. THEREFORE,

$$S.D.F = M.P.F = 3,840 \text{ CFS}$$

(3) EFFECT OF SURCHARGE STORAGE ON MAXIMUM PROBABLE DISCHARGES:

(a) PEAK INFLOW (SDF = MPF)

$$Q_{p1} = 3,840 \text{ CFS}$$

(b) SURCHARGE HEIGHT TO PASS Q_{p1}

(i) ESTIMATE SURCHARGE ABOVE SPILLWAY CREST

HYDROLOGIC / HYDRAULIC INSPECTION

LAKE FOREST DAM, EAST BRIDGEPORT, CONN

(3) (CONT'd) - EFFECT OF SURCHARGE STORAGE ON MAXIMUM PROBABLE DISCHARGES:

(b) SURCHARGE HEIGHT TO PASS Q_{p_1}

(i) ESTIMATE SURCHARGE ABOVE SPILLWAY CREST.

REFER TO DATA IN J. W. CONE "INVESTIGATION OF ISLAND BROOK DAM" 6/1/1966 REPORT.

SPILLWAY DISCHARGE COEFFICIENT $\approx$ 2.7 (BROAD CREST)
LENGTH OF WEIR $\approx$ 35.5

$$Q \approx (2.7)(35.5) H^{3/2}$$

$$H \approx \left(\frac{Q}{2.7 \times 35.5}\right)^{2/3}$$

@ $Q_{p_1} = 3,840$ CFS

$H_1 \approx 11.7'$

3.25 FT FROM SPILLWAY CREST TO DAM CREST

HENCE, THE DAM IS OVERTOPPED. (SPILLWAY ESTIMATED CAPACITY TO TOP OF DAM $\approx$ 560 CFS)

(ii) FIND SURCHARGE HEIGHT H_1

DEPTH OF WATER ABOVE THE TOP OF THE DAM $H_1 - 3.25$

FROM DEP TOPO. MAP (4/12/74), OVERTOPPING MAY OCCUR OVER A TOTAL LENGTH OF DAM OF $\pm$ 1650' (U.S. INVENTORY OF DAMS) OF WHICH PRESENTLY 450' ARE $\pm$ 12' WIDE (TOP) EMBANKMENT AND THE REMAINING 1200' HAVE BEEN WIDENED D/S BY FILL AS BACKYARDS FOR SEVERAL HOMES BORDERING THE LAKE.

Cahn Engineers Inc.

Consulting Engineers

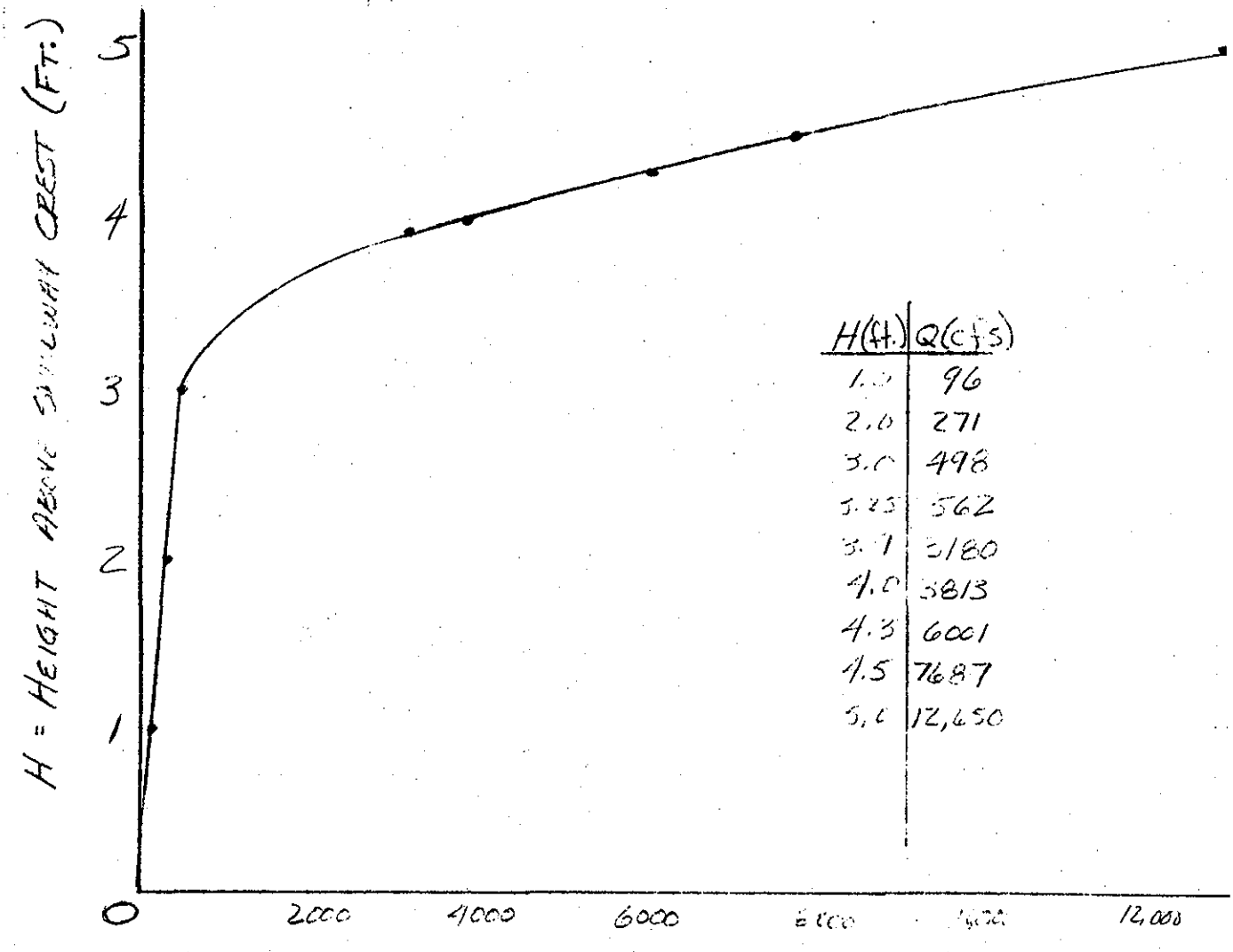
Project LAKE FOREST DAM II | Sheet 1 of 1

Computed By HM/CRG | Checked By | Date 9/8/78

Field Book Ref. | Other Refs. | Revisions

SPILLWAY RATING CURVE

$$Q = 95.9\,H^{3/2} + 4455\,(H-3.25)^{3/2} + 312\,(H-3.25)^{5/2}$$



H(ft.)	Q(cfs)
1.0	96
2.0	271
3.0	498
3.25	562
3.5	2180
4.0	3813
4.3	6001
4.5	7687
5.0	12,650

HYDROLOGIC / HYDRAULIC INSPECTION

LAKE FOREST DAM EAST BRIDGEPORT, CONN.

(3) (CONT'D) EFFECT OF SURCHARGE STORAGE ON MAXIMUM PROBABLE DISCHARGE:

(b) SURCHARGE HEIGHT TO PASS Q_{P_1}

(ii) FIND SURCHARGE HEIGHT H_1

FOR SPILLAGE OVER EMBANKMENT

ASSUME $C \simeq 2.7$

$$Q \simeq (2.7)(1650)(H_1 - 3.25)^{3/2}$$

FOR OVER BANK SPILLAGE.

AT EASTERLY END, ESTIMATE A BERM WHICH RISES APPROXIMATELY 5' IN 400' DISTANCE

ASSUME EQUIVALENT LENGTH OF OVERBANK SPILLAGE (EASTERLY END) $= \frac{2}{3} \times \left(\frac{400}{5}\right) \times (H_1 - 3.25)$

$= 53.3 (H_1 - 3.25)$

ESTIMATE $C \simeq 2.6$

$$Q \simeq (2.6)(53.3)(H_1 - 3.25)^{5/2}$$

AT WESTERLY END, ESTIMATE A BERM WHICH RISES 5' IN 500' DISTANCE.

ASSUME EQUIVALENT LENGTH OF OVERBANK SPILLAGE (WESTERLY END) $= \frac{2}{3} \times \left(\frac{500}{5}\right) \times (H_1 - 3.25)$

$= 66.7 (H_1 - 3.25)$

ESTIMATE $C \simeq 2.6$

$$Q \simeq (2.6)(66.7)(H_1 - 3.25)^{5/2}$$

HYDROLOGIC / HYDRAULIC INSPECTION

LAKE FOREST DAM EAST BRIDGEPORT, CONN

(3) (cont'd) EFFECT OF SURCHARGE STORAGE ON MAXIMUM PROBABLE DISCHARGES.

(b) SURCHARGE HEIGHT TO PASS Q_{P_1}

(ii) FIND TRUE SURCHARGE HEIGHT H_1

HENCE, DISCHARGE WITH SURCHARGE H_1 ABOVE THE SPILLWAY CREST IS

$$* Q = (2.7)(35.5) H_1^{3/2} + (2.7)(165)(H_1 - 3.25)^{3/2} + (2.6)(120)(H_1 - 3.25)^{5/2}$$

$\therefore$ For $Q_{P_1} = 3,840$ CFS

$H_1 \approx 4.0'$

THE TOP OF THE EMBANKMENT IS OVERTOPPED WITH A HEAD APPROXIMATELY $\pm 0.75'$.

(c) VOLUME OF SURCHARGE.

ASSUME NORMAL POOL LEVEL 0.25 FT. ABOVE THE SPILLWAY CREST. (3' ASSUMED FREEBOARD)

AREA OF POOL = 71 Ac. (J.W. CONE REPORT, A = 67 Ac.; C.E. MEASURE A = 71 Ac.; SEELYE STEVENSON VALUE & KENTCH INC., "ISLAND BROOK DRAINAGE STUDY," 1973, A = 76 Ac.; WRC INVENTORY, A = 71 Ac.

FOR $Q_{P_1} = 3,840$ CFS AND $H_1 \approx 4.0'$

VOL. OF SURCHARGE

$$71 \times (4.0 - 0.25) = 266 \text{ Ac-Ft}$$

$$* Q = 95.9H^{3/2} + 4455(H - 3.25)^{3/2} + 312(H - 3.25)^{5/2}$$

HYDROLOGIC / HYDRAULIC INSPECTION

LAKE FOREST DAM EAST BRIDGEPORT, CONN.

(3) (CONT'D). EFFECT OF SURCHARGE STORAGE ON MPF's

(c) VOLUME OF SURCHARGE.

D.A = 1.45 SQ. MI

$$S_1 = \frac{266}{1.45 \times 13.3} \approx 3.45''$$

(d) PEAK OUTFLOW FOR SURCHARGE S_1

(SEE GUIDELINES FOR ASSUMING A TRIANGULAR HYDROGRAPH AND MPF RUNOFF OF ± 19")

$$Qp_2 = 3,840 \left(1 - \frac{3.45}{19}\right)$$

$Qp_2 \approx 3,140$ CFS

$H_2 \approx 3.9'$

$S_2 \approx 3.35''$, $S_{AVG} = 3.4''$

(e) RESULTING PEAK OUTFLOW

$$Qp_3 = 3,840 \left(1 - \frac{3.4}{19}\right)$$

$\therefore Qp_3 \approx 3,150$ CFS

$H_3 \approx 3.9'$

(f) SUMMARY:- PEAK INFLOW : $Qp_1 = MPF = 3,840$ CFS
PEAK OUTFLOW : $Qp_3 = 3,150$ CFS
AVERAGE SURCHARGE HEIGHT ± 3.9' ABOVE THE SPILLWAY CREST.

HYDROLOGIC / HYDRAULIC INSPECTION

LAKE FOREST DAM, EAST BRIDGEPORT, CONN

DOWNSTREAM FLOOD HAZARD

(1) ESTIMATE OF DOWNSTREAM DAM FAILURE HAZARD

(a) ESTIMATE OF RESERVOIR STORAGE AT TIME OF FAILURE. (SEE D. SHEN Comps. 5/22/1978)

(i) MAXIMUM STORAGE CAPACITY = 908 Ac-ft.

(ii) HEIGHT OF EMBANKMENT ABOVE SPILLWAY = 3.25 ft

(iii) MAX. POOL DEPTH AT DAM.
FROM 1908 TOPOGRAPHY BELOW ISLAND BROOK DAM (LAKE FOREST)
TOP OF DAM ELEV ± 175
STREAM BED ELEV. ± 152
± 23.

(iv) ESTIMATED VOLUME OF STORAGE TO MAXIMUM POOL.
USE AREA OF POND = 71 Ac.
$Vol \approx \frac{1}{3}(71)(23) = 540$ Ac-ft < 908 Ac-ft

Use MAXIMUM STORAGE 908 Ac-ft.

(v) ESTIMATED RESERVOIR STORAGE(S) AT TIME OF FAILURE.
(TO A SURCHARGE HEIGHT OF 3.9 ft ABOVE THE SPILLWAY CREST, OR 0.65 ft ABOVE TOP OF THE DAM)

∴ STORAGE $S \approx 908 + 71(0.65) \approx$ 950 Ac-ft

HYDROLOGIC / HYDRAULIC INSPECTION

LAKE FOREST DAM, EAST BRIDGEPORT, CONN

DOWNSTREAM FLOOD HAZARD

(I) ESTIMATE OF DOWNSTREAM DAM FAILURE HAZARD

(b) DETERMINE PEAK FAILURE OUTFLOW

(i) BREACH WIDTH:

FROM TOPOGRAPHIC MAPS OF 1908 AND 1974 A MID-HEIGHT LENGTH OF LAKE FOREST DAM OF $\pm$ 330 ft IS ESTIMATED.

HENCE, TAKE MAXIMUM BREACH WIDTH TO BE APPROX. 0.4 OF THE 330 ft.

MAX. BREACH $W \approx 0.4 \times 330 \approx 132'$

$\therefore$ TAKE $W_b \approx \underline{130'}$

(ii) TOTAL HEIGHT AT TIME OF FAILURE:

$$Y_o \approx 8 + 0.65 = 8.65' \quad \text{SAY } Y_o = 9'$$

(iii) PEAK FAILURE OUTFLOW

$$Q_{P_1} = \frac{8}{27} W_b \sqrt{g}\, y_o^{3/2} \approx \underline{5,900 \text{ CFS}}$$

(iv) DOWNSTREAM WAVE HEIGHT IMMEDIATE D/S AT DAM SITE.

$$Y \approx 0.44\, Y_o$$

$$\therefore Y \approx 0.44(9) \approx \underline{4 \text{ ft}}$$

HYDROLOGIC / HYDRAULIC INSPECTION

LAKE FOREST DAM, EAST BRIDGEPORT CT.

(A) MPF ESTIMATE FROM THE HIGH INTENSITY RAINFALL PERIOD OF A SHORT DURATION STORM IN A SMALL WATERSHED

THIS PARALLEL COMPUTATION IS MADE CONSIDERING THAT FOR SMALL DRAINAGE AREAS, USE BY EXTRAPOLATION OF THE MPF GUIDE CURVES FURNISHED BY THE ACE NEW ENGLAND DIVISION, MAY GIVE PEAK RUN-OFFS OF LESSER MAGNITUDE THAN THOSE WHICH COULD PROBABLY OCCUR.

ASSUME FOR LAKE FOREST A TIME OF CONCENTRATION OF ABOUT 1-HR. IN THE HIGH INTENSITY RAINFALL PERIOD OF A 6-HR RAINFALL FOR ESTIMATING THE MAX. PROBABLE RUN-OFF

a) 6-HR PMP AT LAKE FOREST : PMP = 24.5" (10 SQ MI EPT. RAINFALL)

(FROM USBR "DESIGN OF SMALL DAMS" - FIG 1, P. 29 BASED ON HYDROMETEOROLOGICAL REPORT N° 33 - US WEATHER BUREAU / US CORPS OF ENGINEERS)

b) ASSUME MOST INTENSE 1-HR PERIOD RAINFALL = 51% OF THE TOTAL 6HR RAINFALL (USACE 55% - USBR 50% - SCS 47%).

∴ PMP FOR 1-HR PERIOD AT LAKE FOREST = 12.5 "/HR.

c) ASSUME PMF FOR THIS DA = 70% OF THE ABOVE PMP OR,

PMF = 8.8 "/HR. ∴ $Q_p = 1.45 \times 8.8 \times 645.3 = 8200$ CFS

*NOTE: THIS CORRESPONDS TO USE OF RATIONAL METHOD WITH C = 0.70 TO 0.71

D-15

HYDROLOGIC/HYDRAULIC INSPECTION

LAKE FOREST DAM (Cont'd)

2A) THE DAM IS CLASSIFIED AS SMALL WITH HIGH HAZARD POTENTIAL

∴ SDF RECOMMENDED BY GUIDELINES: ½ PMF TO PMF

ASSUME SDF = PMF = 8200 CFS (PEAK INFLOW)

3A) EFFECT OF SURCHARGE STORAGE ON MAX. PROBABLE DISCHARGE

a) FOR Q_{P_1} = 8200 CFS (SEE D.S. SHEN 5/25/78 COMPS p.5)

$H_1 \doteq 4.56'$, SAY 4.6' (DAM OVERTOPPED BY ± 1.3')

b) VOL. OF SURCHARGE @ $H_1 \doteq 4.6'$

$V_1 = 71\,(4.6 - 0.25) = 309$ AC FT (DA = 1.45 Sq mi)

$$\therefore S_1 = \frac{309}{1.45 \times 53.3} = 4.0''$$

c) ASSUMING THE MPF FLOOD RO IN NEW ENGLAND (SEE GUIDELINE) APPROX. EQUAL TO 19"; AND THE R.O. IN 6 HR TO BE 83% OF THE 24 HR R.O., THE PEAK OUTFLOW CAN BE ESTIMATED AS FOLLOWS (SEE GUIDELINES):

$$Q_{P_2} \doteq Q_{P_1}\left(1 - \frac{S_1}{15.8}\right) \qquad (19 \times 0.83 = 15.8)$$

$$\therefore Q_{P_2} \doteq 8200\left(1 - \frac{4}{15.8}\right) = 6100 \text{ CFS} \quad \therefore H_2 \doteq 4.3'$$

D-16

HYDROLOGIC/HYDRAULIC INSPECTION

LAKE FOREST DAM (Cont'd)

3A - Cont'd) EFFECT OF SURCHARGE ON MAX. PROBABLE DISCHARGE

d) $V_2 = 71(4.3 - 0.25) = 288$ ACFT

$\therefore S_2 = 3.7"$ $S_{AVG} = 3.85"$

e) RESULTING PEAK OUTFLOW (Q_{P_3}) AND AVE. SURCHARGE (H_3)

$Q_{P_3} = 8200\left(1 - \frac{3.85}{15.8}\right) = \underline{6200}$ CFS

$H_3 = 4.32$ SAY, $\underline{4.3'}$

f) SUMMARY,

PEAK INFLOW $Q_{P_1} = \text{MPF} = 8200$ CFS

PEAK OUTFLOW $Q_{P_3} = 6200$ CFS

AVE. SURCHARGE $H_3 = 4.3'$ (ABOVE SPILL. CREST)
DAM OVERTOPPED $\pm \underline{1.1'}$

D-17

NOTE: These computations have been performed based upon a dam breach with a surcharged water surface elevation. In accordance with normal Corp procedures, computations are performed based upon a water surface elevation at the top of the dam. A dam breach with the water surface at the top of the dam and without heavy downstream channel flow could be more critical than a dam breach with a surcharge. The difference, in this case, is not substantial.

APPENDIX E

INFORMATION AS CONTAINED IN

THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

(1) STATE	(2) IDENTITY NUMBER	(3) DIVISION	(4) STATE	(5) COONTY	(6) CONGR DIST.	(7) STATE	(8) COUNTY	(9) CONGR DIST.	(9) NAME	(10) LATITUDE (NORTH)	(11) LONGITUDE (WEST)	(12) REPORT DATE DAY	MO	YR
CT	78	NED	CT	001	04				FOREST LAKE DAM	4113.2	7312.5	15	AUG	78

(13) POPULAR NAME	(14) NAME OF IMPOUNDMENT
LAKE FOREST DAM	LAKE FOREST

(15) REGION	(16) BASIN	(17) RIVER OR STREAM	(18) NEAREST DOWNSTREAM CITY–TOWN–VILLAGE	(19) DIST FROM DAM (MI.)	(20) POPULATION
01	07	ISLAND BROOK	BRIDGEPORT	0	153000

(21) TYPE OF DAM	(22) YEAR COMPLETED	(23) PURPOSES	(24) STRUCTURAL HEIGHT (FT.)	(25) HYDRAULIC HEIGHT (FT.)	(26) IMPOUNDING CAPACITIES MAXIMUM (ACRE–FT.)	(27) NORMAL (ACRE–FT.)	DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
RECTPG	1899	R	29	28	908	852	NED	N	N	N	N	09AUG78

(28) REMARKS

(29) D/S HAS	(30) SPILLWAY CREST LENGTH	(31) TYPE	(32) WIDTH (FT.)	(33) MAXIMUM DISCHARGE (FT.)	(34) VOLUME OF DAM (CY)	(35) POWER CAPACITY INSTALLED (MW)	(36) PROPOSED (MW)	(37) NO.	(38) NAVIGATION LOCKS LENGTH (FT.)	(39) WIDTH (FT.)	(40) LENGTH (FT.)	(41) WIDTH (FT.)	(42) LENGTH (FT.)	(43) WIDTH (FT.)	(44) LENGTH (FT.)	(45) WIDTH (FT.)
1	1650	U	36	560	32511											

(46) OWNER	(47) ENGINEERING BY	(48) CONSTRUCTION BY
LAKE FOREST ASSOCIATION	S G STODDARD JR	

(49) REGULATORY AGENCY DESIGN	(50) CONSTRUCTION	(51) OPERATION	(52) MAINTENANCE
STATE OF CT	NONE	NONE	NONE

(53) INSPECTION BY	(54) INSPECTION DATE DAY	MO	YR	(55) AUTHORITY FOR INSPECTION
CAHN ENGINEERS, INC	23	MAY	78	PL 92-367

(56) REMARKS